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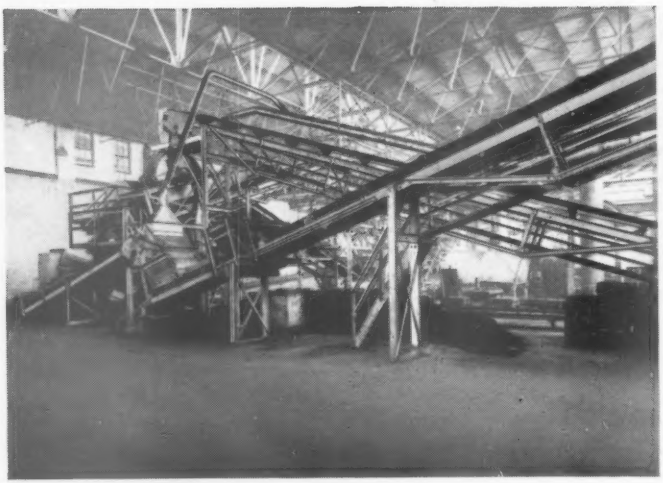

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Weakness Revealed

We have had the opportunity of discussing the recent European Foundry Apprentice Competition with several of those who were present. There is a unanimous opinion that the judging was scrupulously fair and the award of the first place to the Germans was well justified. The location of the British team amongst the "also-rans" was to be expected, as no national organization existed for the selection of the most appropriate candidates. Rightly, some of the Continental entrants were chosen as the result of large-scale internal tests. We have reason to believe that at Stuttgart, the British boys put up an excellent show on the practical side, but were not so good at expressing themselves in good English, when answering questions.

In such a competition, there is an obvious advantage to a "home" team as there is familiarity with the surroundings, materials and general requirements. However, this, in the course of time, will level itself out, as the contest is to be held in a different country each year. It is scheduled to reach Britain in four years' time. For UK founders, the major lessons to be learned from this contest are: there is a weakness caused by the absence of an overall employers' association for the foundry industry as a whole; the non-existence of a national unified training system for apprentices, carrying a certificate of competence for those who satisfy the examiners, and the absence of sponsored and approved textbooks for apprentices. By and large, in other European countries the reverse is true.

Last week, we attended four meetings covering various aspects of foundry education, and we felt that the work of all of them would be simplified if there was a general directive from a high authority through which the general pattern of foundry education and training could be integrated. At the moment, every phase of training is being covered—all excellent in their way—from the trade apprentices to post-graduates. Yet there is no truly representative body to say which are adequate or which need strengthening. A large firm operating its own school would benefit from co-operation with a central body—and the advice such an organization could give as to whether use should be made of external training facilities and examining authorities. The specialized schools associated with the industry are flourishing, and are asking for increased accommodation. Directing these schools and colleges are the representatives of all the major sections of the industry. How much simpler it would be if there was but one *communauté* which could approve of a fixed policy and see it through, with the whole force of the industry behind it. Unquestionably, the notion of a properly constituted authority for the foundry industry is gaining ground.

Correspondence

"ASKING FOR TROUBLE"

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—May I offer comment on the concluding paragraph of the leading article in your December 5 issue, "Asking for Trouble," concerning ". . . the deleterious association of the word 'defect' with . . . castings," in foundry literature, and reading as follows: "Anything that can be done to eradicate this notion ('a close association between castings and defects') will make a serious contribution to putting the foundry industry into its correct perspective." This must take into account the very considerable contributions, as to "correct perspective," by the British Steel Founders Association's "Customer/Founder Conventions" of April, 1953, and November, 1956.

The universal habitual use of the word "defect" *is* unfortunate in its catholic (all embracing) sense when it has to be accepted, universally, that the degree of soundness of sand-moulded castings (as-cast) has a fundamental relation to the natural laws governing the liquidus/solidus contraction rate of the metal cast—in the case of steel, very notably indeed. However, in considering this word defect we must consider also its equally unfortunate correlative, the word "repair." These two aspects were brought out in the *Proceedings** of the November, 1956, BSFA Customer/Founder Convention (reported in your December 13, 1956, issue) in the discussions of Dr. Dadswell's paper, "Fulfilling Requirements," in which the writer expressed his agreement with Dr. Dadswell that the word "repair" is unfortunate (p. 21 of the *Proceedings*), and requested members of the B.S.1 Steel Castings Drafting Committee to consider deletion of the word "repairs" from the "Code of Welding" in the British Standard Specifications concerned, and substitute the word "rectifications."

In his paper also, Dr. Dadswell postulated the word "blemish" in replacement of the word "defect" and although the word "blemish" can mean "to mar perfection," it can mean also, "physical defect or flaw," and in the writer's paper, "Acceptance Standards" (for steel castings for electricity generating plant and marine-propulsion machinery), a clear distinction was made as to "blemishes" which need not be weld "repaired" and "defects" which must be weld "repaired." Thus, in all circumstances, "rectification" (not "repair") has to be considered where there are metal "discontinuities" as distinct from "defects"—*according to functional significance.*

It has been the writer's purpose, as "customer" representative, at the BSFA Customer/Founder Conventions to help confine these problems to the sources of casting manufacture and this implies his agreement that "the real use of these albums of defects was to establish a nomenclature and help translation, and their purpose should have been confined to the technologists within the industry."

Yet if we take too literally (and obtusely) the title of Mr. Dieterts' leading article (*Modern Castings*, November, 1957)—"Scrapping a Bad Habit"—then a too-close "confinement within the industry" may result in the bad habit of scrapping salvageable castings in "notifiable" cases such as illustrated in the present writer's paper, "Acceptance Standards." Also, it was a principal purpose of the BSFA conventions to "educate" customers as to the technical problems associated with steel castings manufacture as a follow-up of the wide circulation of *Bulletins* giving technical information for designers, under a variety of headings, with appropriate nomenclature. This "education" has had far-reaching effects and under the auspices of the BSFA and the British Steel Castings Research Association it proceeds apace.

The second convention, November, 1956, was designed, in effect, to bring the words "defect" (and "repair") "into correct perspective"—for discussion by authoritative representatives of users, ultimate customers, and leading inspecting and surveying bodies. There was little or no dissent with the premises put forward.

Nevertheless, the present writer, logically, is in full support of Mr. Dieterts' injunction to "think, talk, and write 'quality control,' not 'defect control.'" But as a "customer" the writer must assume that this means, where applicable, "quality control" of "rectified" castings *according to functional significance.*—Yours, etc.,

A. C. ANNIS.

327, Princess Road, Fallowfield, Manchester 14.

*Since published by the BSFA.

Smith Patterson's honour their Secretary

Photograph taken on the occasion of a farewell dinner to mark the retirement of Mr. Andrew Thompson, secretary of Smith Patterson Company, Limited, for 54 years. From left to right: (seated) Mr. G. A. Cowen (director), Mr. Thompson, Sir Jonah Walker-Smith (chairman) and Mr. R. Redpath (director and foundry manager); (standing) Mr. John Pickering (the new secretary) and Mr. A. N. S. Goodger (secretary, Taylor Stoker Company, Limited, an associated company).

Application of the CO_2 Process in the Production of Steel Castings

*By I. Rees**

The Author's foundry is essentially a jobbing foundry producing castings from a few pounds up to 10 tons net weight in plain-carbon and low-alloy steels. The Process has been found to be a valuable aid to production. The results obtained have amply repaid the time and effort put into the development of the process and its use has overcome many production difficulties brought about by scarcity of skilled labour and limitations of equipment and floor space. It is most certainly not the answer to all foundry problems, but if properly used within its limitations, it has tremendous advantages for certain moulding techniques and types of work.

Green-sand Moulding

In foundries almost entirely on green-sand work, the only application of the Process will be for cores, either internal cores or blocking-out cores. In both cases, difficulty has been experienced. Usually blocking-out cores make re-entrant corners into the casting, and the strip has been poor, especially if the section of the casting made by the core is below 1-in. to 1½-in. thick. Internal cores have proved troublesome especially when there is a heavy metal section around the core. None of the breakdown agents tried give satisfactory knock-out under these conditions. On the other hand, a core of large section surrounded by a relatively thin metal section gives not only knock-out difficulties, but also leads to distortion due to the plasticity of the silicate-bonded core at high temperature. It has been found that with 1 per cent. molasses addition to a straight sodium-silicate bond, there is an intermediate range of core-size in relation to the section of metal around the core where breakdown is satisfactory.

It will be apparent that the usefulness of the CO_2 Process is limited in coremaking for the class of work usually made in green-sand. It has been the experience of the Author's firm that in this class of work, only a few types of castings can be successfully cored using the CO_2 Process, where the metal section happens to be favourable.

It is thought that a mould-coating does not improve the strip, and silica- or zircon-based alcohol dressings have not brought about any improvement in the strip of the type of castings normally made in green-sand; in fact, under certain circumstances a worse strip has been produced by using a coating. This does not, however, apply to the heavier class of castings.

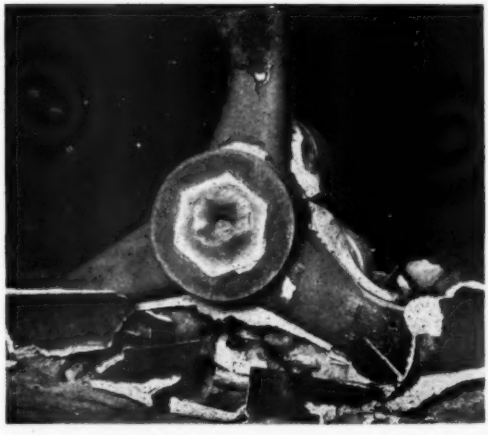
Medium to Heavy Jobbing Work

The widest application of the CO_2 Process has been found as a moulding material in the medium to heavy class of casting where the minimum section of the casting is at least 1½-in. thick. The use of sodium silicate as a bonding material for internal cores presents less of a problem in this range of casting size, but at this stage of development, breakdown still presents certain difficulties and conventional binders are still used for a large number of internal cores.

Above about 1½-in. metal section, most silica sands hardened by CO_2 give a clean strip, provided the pouring temperature is high enough. The grain-size of the base sand determines only the roughness of the strip for steel castings. A good example of the strip obtained from a mould produced by the CO_2 Process is shown in Fig. 1. The casting is a plain carbon-steel disintegrator rotor weighing about 7 cwt. The blade-section is about 4-in. thick, and stripped well from an uncoated mould. The mould for this symmetrical casting was made up by core assembly from one-third of the pattern. The core was also made by the CO_2 Process, and whilst the knock-out was not all that could be desired, the strip was very good. In the type of casting shown, CO_2 centre cores strip very cleanly from the casting once the centre of the core is removed.

The Process has been used as a substitute for normal dry-sand moulding. It was found that the success of the method depended entirely on the condition of the pattern equipment, if the mould was hardened before stripping. Where difficulty was experienced in stripping, the green strength of the binder was increased by additions of a clay which enabled the pattern to be stripped before gassing.

FIG. 1.—*Plain carbon-steel disintegrator rotor casting.*



* Foundry manager, Glanmorfa, Limited. The paper was presented to a conference of the British Steel Castings Research Association.

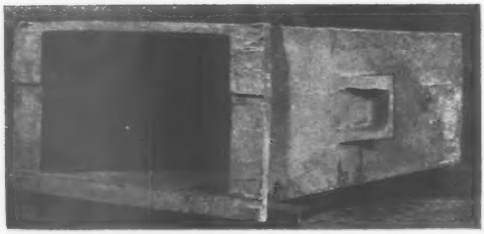


FIG. 2.—*Steel slag-chute casting.*

For the earlier experiments, in the interests of economy, moulds consisting of a CO_2 facing-sand backed with green-sand were used as a substitute for conventional dry-sand moulds. The tests so far carried out show that the method is only applicable for jobs in the 10-cwt. to 1-ton range. In the region of 1 ton, the shell of CO_2 sand is not sufficiently strong to withstand pouring, and bulging takes place. Above this weight, it is necessary to ram up the box completely with CO_2 sand to obtain the support of the moulding box. However, the quantity of the sand used can be reduced by careful bricking up and the CO_2 sand acts as a cement between the bricks. About 3 to 6-in. of sand is allowed between the bricks and the casting face, depending upon the section of the casting. A casting produced by this method of moulding is shown in Fig. 2., The casting, a steel slag-chute, was in two parts from a resin/core-sand 4-ft. 6-in. wide, 3-ft. deep. The mould was made from a bentonite/sodium-silicate mix which gave quite a reasonable strip. The usual time taken to make this job in dry sand would be a week. Using the CO_2 Process, the first of these castings was produced in one and a half days.

The normal method of making the core for the slag-chute was in two parts from resin/core-sand mix, and it would have taken three days to dry; by using the CO_2 Process, it was ready to place in the mould within 6 hours. The core irons used were two lengths of railway-line and two hooks. The inside was filled with ashes. The approximate weight of the core was 5 tons.

The Process has also been applied to floor moulding. It has been found possible to strike up a bed of CO_2 sand over the usual ash-bed, although CO_2-bonded sands will not strickle in the usual sense very easily, and special techniques have to be developed. The technique adopted is similar to that used in the preparation of concrete beds. Once a bed is formed, a frame pattern is used, and the job is rammed up and gassed in sections. The CO_2 Process eliminates the use of mould driers, and results in a considerable saving in the time the mould is on the floor.

Core-assembly Method of Production

It is considered that possibly the most advantageous application of the CO_2 Process is in the field of core-assembly. Demands on a jobbing foundry fluctuate widely and in the particular case the Author's firm are called upon to meet short delivery times on rolling-mill breakdown jobs. In the ordinary way, this would mean carrying a large range of tackle. The answer to the difficulties, therefore, was the core-assembly method of production.

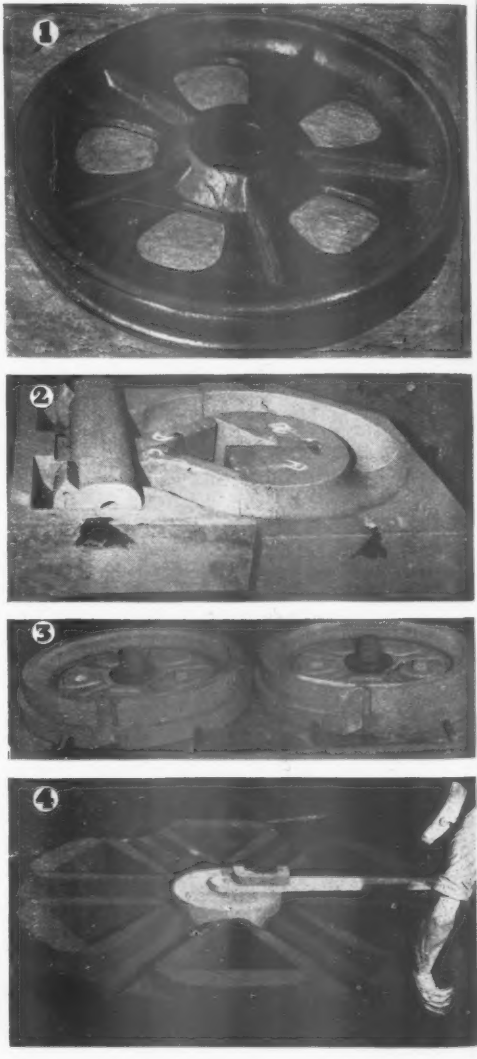


FIG. 3.—*Typical production in small core assemblies is here illustrated by* (1) *a pulley sheave casting,* (2) *core assembly for shackle casting,* (3) *bottom cores for pulley sheave casting, and* (4) *cores being placed on a strickle-bed by means of a strickle-board gauge.*

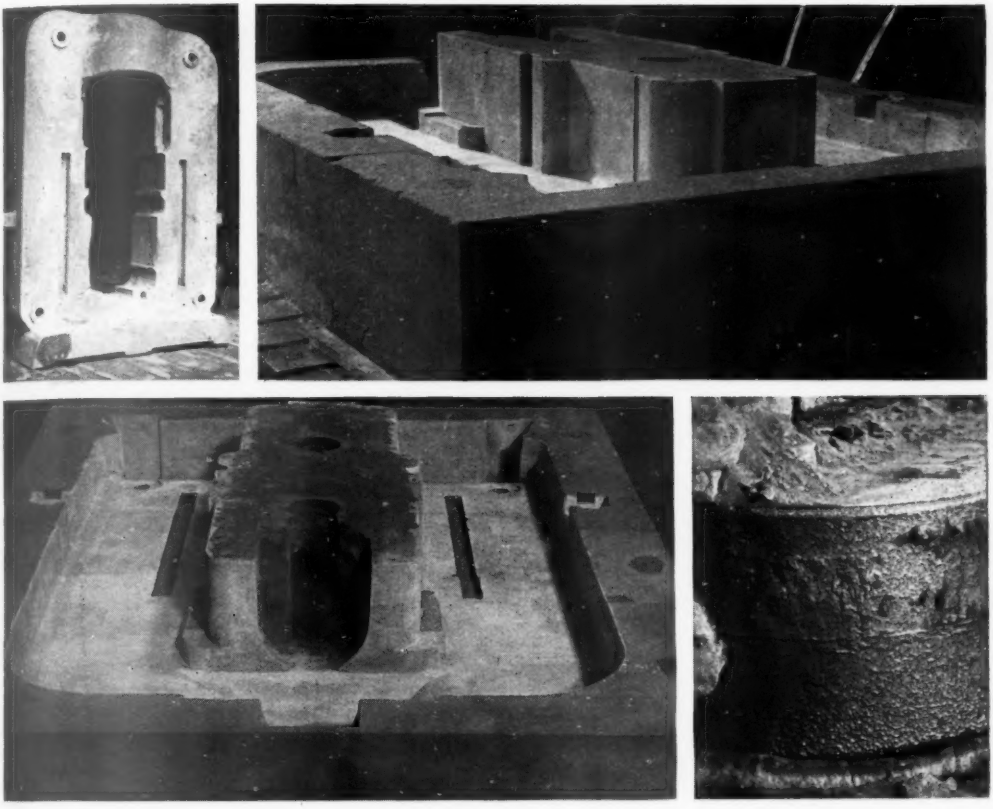


FIG. 4.—*Production of a heavy casting by the CO_2 Process. Top left shows the finished* 10*-ton rolling-mill stand; the start of the core assembly is shown, top right; a further stage in mould build-up, bottom left, and an enlarged section of the finished casting* (*bottom right*) *indicates the clean strip secured.*

Normally, this method finds most application for small castings where large numbers are required which can be produced in shallow slab cores. When the method is applied to large castings in the 5- and 10-ton range, a number of difficulties arise when using conventional binders due to the size of the individual cores necessary to form the mould. For cores weighing 1 ton and over, handling, turning over, stripping, etc., become a problem, great care having to be taken to prevent sagging during transport. Even with extreme precautions in handling, distortion presents a major problem and considerable time is spent in the foundry rubbing cores to fit, and in jointing. The problem of distortion alone using conventional binders, apart from the relatively high cost of sand, has limited the use of the method in the past.

However there was no alternative if a breakdown service was to be provided, and after a considerable amount of work, suitable conventional sands and a technique for producing large cores with the minimum of distortion were developed. The high cost of raw materials was more than offset by savings in other directions: (*a*) pattern costs are reduced on a large number of castings; (*b*) cores can be stacked until required: thus, large moulds, normally occupying floor space for several weeks, only require the space for a few days during assembly before being cast; (*c*) there is a much faster turn-round in the foundry as the mould is formed in sections, each mould can be made much faster in the same space by more men, and overall production is greater. In fact, production was approximately doubled by using this method in conjunction with conventional dry-sand moulding technique over a period of three years.

With the advent of the CO_2 Process in this country, the method seemed to be ideally suited to the core-assembly method. The change-over from conventional binders required no outlay except CO_2 gas equipment, and the firm was well equipped to deal with the new approach to pattern equipment.

CO_2 Process for Steel Castings

The immediate advantage was the elimination of stoving and the consequent speeding of production of the cores. This also applied to floor mould assemblies, as it was found possible to strickle up a bed of CO_2 sand and harden side-cores in position.

The application of the CO_2 Process to the core-assembly method had the following advantages as compared with the use of conventional binders: (*a*) the cores were found to be more accurate, and by the use of collapsible coreboxes were true to size; (*b*) no distortion took place on stripping and during transport.

Thus, the two major disadvantages of core-assembly as applied to large castings were immediately overcome. Assembly times were considerably reduced, as the greater dimensional accuracy meant that cores no longer had to be rubbed down to fit. Pattern clearances were reduced and castings came out more accurate dimensionally. In addition, fettling was reduced.

The Process did, however, throw heavier demands on the patternshop, but the firm had ample facilities. The important point was the increase in foundry production brought about by the increased accuracy of the cores.

Handling was tremendously reduced. No heavy rigid coreplates were required, as cores were taken straight from the box. Cores could be made at the point of assembly, in order of assembly, thus reducing the problem of coring up. Furthermore, it was often possible to ram up the base- and centre-cores together on the actual assembly site; this reduced the problem of handling very large cores, and by this method it was possible to produce cores of 25-ft. in length without core-irons at all. This, of course, would be impossible with conventional binders.

It was also possible to reduce the number of cores required for assembly, since quite complicated cores could be made and lifted directly from the box which would otherwise have had to be split up to give flat-backs for turning out and carrying.

Over a period, it was found that less core sand per ton of casting had been used, since it was now possible to brick up cores and thus save sand. In the original core-assembly method, bricking up had not been possible to anything like the extent that was found to be possible in the CO_2 Process.

After a few initial trials, these advantages became more and more apparent, and the CO_2 Process has now become a major feature of this method of production. Conventional binders, however, are still used for cores where difficulty in breakdown and knock-out has been experienced with CO_2 sand cores.

Typical production in small core-assemblies is shown at various stages in Fig. 3. The first illustration is the usual type of pulley sheave, 28-in. dia., which was produced in large numbers by means of a half-pattern producing a reversible core and a rim-core, each complete mould can be produced in one hour. In this particular instance, the core-irons in the core were so designed as to provide handles for lifting and turning over the cores as shown at (3). A typical core-assembly used to produce a mooring-anchor shackle is illustrated at (2). With such symmetrical castings $\frac{1}{4}$, $\frac{1}{8}$ and $\frac{1}{16}$ patterns in coreboxes are not unusual when designing the mould by the core-assembly method.

When using the core-assembly method of production, one of the major problems is to obtain an accurate register of each core against its neighbour. The problem is relatively easy with square cores and the design can be adjusted accordingly. For radial core-assemblies, the strickle board is still used as can be seen at (4), but in this case as a location-jig for the placing of the cores. In this way, even loam-moulding can be improved upon both in floor-time per casting, and cost of production.

In general, core-assemblies for smaller castings are not backed up or secured by ramming in boxes. The cores are assembled on a machined plate or old machine-bed and clamped down by means of plates, tie-bars and wedges. Thus, a large number of boxes are not required. Furthermore, the positioning of gates and heads is not limited by the position of box bars. For the heavier type of casting, cores are assembled on a strickled bed or machined plate inside a single frame. The cores are designed in such a way that they can be lifted directly from the box, which may be collapsible, and placed in position. This eliminates the need for turning over, hence reduces cranage and the need for extensive core-irons.

One of the heaviest steel castings made by the CO_2 Process is shown in Fig. 4, a 10-ton rolling-mill stand. Two views of the core-assembly in the course of construction is shown (top right, bottom left). The cores, which were left standing for a considerable period of time, were painted with a zircon-based alcohol dressing to prevent friability. An example of the strip obtained on this casting is also shown (bottom right). Large areas of sand fell away as the stand was lifted from the moulding frame. The window core was made in CO_2 sand and gave excellent strip and accuracy. The slide cores and bottle cores were made from a zircon/dry-sand mix as CO_2 would not have stood up to the heavy section of metal and severe penetration would have occurred.

Conclusion

A brief outline has been given of the advantages and limitations of the CO_2 Process as applied to the class of work produced at Glanmorfa Limited. It is felt that the results so far have been ample reward for the time and money spent in developing the Process, but, technically, the present stage of development leaves a lot to be desired, especially in relation to knock-out properties. Although the cores bonded with sodium silicate have relatively low strength compared with the conventional binders (and dry-sand), much can be achieved and great advantage gained by using the Process.

Fifty-year-service Presentation

Some 70 members of the staff of R. & A. Main, Limited, Edmonton, recently attended a celebration dinner at Gothic Works, Angel Road, in honour of Mr. C. Marley, a director of the company, who completed his 50th year of service on November 16.

Mr. Marley, who joined Glover & Main, Limited, in 1907 as an indentured apprentice in the engineering department of Thomas Glover & Company, Limited, has since held a number of progressive posts in the Main organization, becoming in 1950 joint managing director of R. & A. Main, Limited, and in 1952, upon his election to the board of Glover & Main, Limited, also joint managing director of Main Water Heaters, Limited. Although he has since relinquished the managing directorships, Mr. Marley remains on the board of the two companies and of Glover & Main, Limited, and

Mr. C. Marley receiving an illuminated address at a dinner held to celebrate his 50 years with the Main organization.

Main Enamel Manufacturing Company, Limited. He is also a director of Morley Products (Padiham) Limited, a further associated company within the Glover & Main Group.

Following the proposal of the loyal toast at the dinner, Mr. Dick Perry, who himself has a record of 38 years' service with the company, presented Mr. Marley with an illuminated address and this was followed by a second presentation, by Mr. J. V. Bew, of an electric grinder for installation in Mr. Marley's home workshop. In his acknowledgments Mr. Marley quoted the well-known adages "If a job's worth doing, it's worth doing well," and "Earn a pound and spend nineteen and eleven pence and the result is a happy man, but earn a pound and spend a pound and a penny and the result is abject misery," saying that this was the best advice he had ever received. The toast to "Our Company" and the vote of thanks concluded an enjoyable evening.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS, LIMITED, of Rugeley, Staffordshire, announce that the British Standards Institution have granted licences covering the use of the B.S. "Kite" mark on their smoke-alarm and density indicator series SME2.

Pipe Roughness and Flow Measurement

A paper of interest to pipe founders (and large users of pipes) by W. J. Clark, M.SC., PH.D., and R. C. Stephens, B.SC., entitled "Flow Measurement by Square-edged Orifice Plates: Pipe-roughness Effects" has been presented to the Institution of Mechanical Engineers. The preprint records the following synopsis: This paper presents the results of experimental work carried out recently to determine the effects on the discharge coefficient of various degrees of pipe-roughness adjacent to and at different distances from an orifice plate. Experiments were carried out for air flow in 12-, 6-, and 3-in. dia. pipes and water flow in 3-in. dia. pipes. Downstream, severe incrustation has no significant effect; upstream, the effects vary with degree of roughness, pipe diameter, m value, and Reynolds number. For an m value of 0.5 and severe conditions of roughness, the combined effects of roughness and pipe diminution produce disturbance factors of the order of 1.40, 1.17, and 1.08, respectively for 3-, 6-, and 12-in. pipes. A length of two diameters of rough pipe immediately up-stream from an orifice plate gives an effect close to that which would be obtained for a very long rough pipe. It has been found possible to extrapolate the results to very large pipes.

One of the most important findings is that cleaning a rough upstream pipe adjacent to an orifice plate for a relatively short distance reduces errors which may be otherwise very considerable to within known small limits. A table detailing the extent of such cleaning for various pipe sizes, m values, and degrees of roughness is given. It is recommended that, where reasonable accuracy is required in the flow measurement of dirty fluids, installation should be designed for easy periodic inspection and cleaning of the upstream pipe adjacent to the orifice plate.

Canadian Trade Mission Visit

A group of seven members of the Canadian Trade Mission visited the Huddersfield and Barnsley works of Brook Motors, Limited, on December 6. Leading the party in the absence of the Hon. Gordon Churchill was Mr. J. S. Duncan, chairman of the Hydro Electric Power Commission of Ontario, Toronto. After a quick tour of the main production lines at Huddersfield, the party were transported to the Barnsley Works where they were able to see the electronically-controlled winding-conveyor system. They were conducted round the works by the directors who also entertained the party to luncheon.

The visitors were informed of the intention of Brook Motors, Limited, to expand business in Canada considerably next year, and were shown advance designs of electric motors ultimately designed for the Canadian market. Mr. Frank V. Brook, chairman of the company, said that they were by no means satisfied with their present level of trade with Canada, a matter which they hoped to rectify by intensified sales efforts in the near future. Mr. J. S. Duncan in reply said the mission had been impressed by the effort made by British industry to capture the Canadian market. Canada purchased eight to nine times the amount of goods from the USA than she did from Britain; it was the mission's purpose to encourage British industry to take a larger share of this business.

Equipment & Supplies

Soldering Iron

Of entirely new design, Model No. 92, lightweight model soldering iron has been developed by Wolf Electric Tools, Limited (Pioneer Works, Hanger Lane, London, W.5), to meet the requirements of continuous small assembly work. The element is wound on a flat mica strip and folded with an interposing mica insulating piece. It is then encased in mica and enclosed within a rectangular section steel casing. The cable and sleeve are securely clamped into position and an earth symbol, permanently marked, conforms to various international regulations. Perfect balance and sturdy construction, plus rapid heat-up and constant working temperature are claimed; the consumption is 25 w., weight, 3 oz., and it is available to suit seven standard voltages.

Elevator Truck

Powell & Company, Burry Port, Carmarthenshire, announce an addition to their range of "Vertolifter" hand-operated hydraulic elevator trucks, illustrated in Fig. 1. This model incorporates the new size of platform, 20 by 21 in., and is available with two heights of lift, 48- and 60-in. The load capacity is 500-lb.; all moving parts have either ball or roller bearings; the hydraulic pump is double acting and finger-tip control permits the load to be lowered swiftly or slowly with instant stopping at any point. The overall width of 23½ in. is standard on all models.

FIG. 1.—*Hand-operated elevator truck produced by Powell & Company.*

Distribution of Fuel Oil

In order to meet increasing demand in the Midlands, distributing arrangements have been inaugurated whereby the full range of "Mobil" fuel oils is now available in the counties of Derbyshire, Leicestershire, Rutland, Shropshire, Staffordshire, Warwickshire and Worcestershire, through Charrington, Gardner, Locket & Company, Limited. A sales office has been established at Beaufort House, Newhall Street, Birmingham and the firm has built a bulk-storage terminal at Bedworth, on a 14-acre site which previously formed part of Exhall Colliery, at a cost of more than £40,000. Delivery will be by Charringtons' own fleet of road tankers.

A LEAFLET received from the Monometer Manufacturing Company, Limited, 115-116, Strand, London, W.C.2, describes and illustrates an adjustable swinging-arm ladle-heater for preheating various sizes of foundry ladles. The heater is fired by a low-pressure air-regulated fuel-oil burner (complete with oil and air control valves) or, alternatively, is arranged so as to be gas-fired. Air supply may be provided by individual direct motor-driven fans or by one fan to serve multiple units.

Law Cases

Uneven Floor Quite Usual

Dismissing, with costs, a claim for damages brought by a Hoole steelworker, arising from an accident which occurred on the floor of the ingot-casting bay at the Hawarden Bridge Steelworks, his Honour Judge H. Emlyn Jones, at Chester County Court recently said that there was no doubt in his mind as to how and why the accident had happened. The whole issue depended on the nature of the floor, on to which the plaintiff had apparently stepped down "fairly sharply." It was, he commented, the kind of floor which could naturally be expected near the furnace in a great steelworks.

The plaintiff, Mr. W. E. Craven, for whom Mr. Ian Fife appeared, submitted that he had sustained a severe injury because the floor, which consisted of hard packed sand, and a covering of ashes, was uneven. Under cross-examination he agreed that he had never seen concrete used for the floor of the casting bay of a steelworks.

Summing up, the Judge said that it was his considered opinion that the floor was reasonable and that it would therefore be wrong to say that the defendants were guilty of breach of duty. The case had to do with the casting bay in a great steelworks, not with a boudoir.

Bad Lighting Alleged

Thomas Firth and John Brown, Limited, were defendants in a case which was dismissed at Sheffield County Court by Judge Ould, when Mr. Thomas William Hardwick, borer, a former employee of the firm, claimed £400 damages for injuries received in a fall at work. Mr. Hardwick said that he was working in a machine shop at the firm last December when he had occasion to leave his bench. It was necessary to cross a yard and this was not illuminated except from a light at the main gatehouse and another shining through the glass panel of a door. He knew there were railway lines in the yard, and he stumbled over these. He was off work for two months, and his ankle was in plaster for a month.

It was alleged by the firm that Hardwick had failed to step over the lines properly and that he had not made use of proper facilities provided. A gatekeeper and a labourer told the court they could not remember when the lights were not on in the yard. The Judge said no person had been called to support the case on the question of lights, and he was not prepared to say there was a defect in the floor and that such defect caused the accident. He therefore dismissed the claim.

A.E.I. LAMP & LIGHTING COMPANY, LIMITED, have recently made for special projects a number of single-lamp, 5-ft. fluorescent fittings designed for use in humid atmospheres where condensation either of water or more corrosive liquids may either occur on the fitting or result in liquid falling from above. Known as the "Watershed" model, these will be incorporated in the standard range in two versions: the "Standard" (suitable for use in all non-corrosive atmospheres of high humidity) and the "Anti-Corrosion" (which will withstand highly corrosive conditions). Both fittings consist of a "Perspex" or PVC combined watershed and reflector.

Recent Developments in the Manufacture of Castings*

By J. L. Rice, B.Met., R. W. Ruddle, M.A., and P. A. Russell, B.Sc.

[ABRIDGED]

(*Continued from page 702*)

Having dealt with both established and new foundry processes, and with developments in cast-iron, copper and aluminium alloys during the last five to ten years this comprehensive review proceeds to give some account of progress in the fields of magnesium alloys and alloys intended for service at high temperatures. It concludes with an account of minor developments and an outline of future trends in so far as these can be predicted.

Magnesium Alloys

In contrast with the copper- and aluminium-alloy fields, considerable developments have taken place in magnesium alloys during the last 10 years, these being consequent on the discovery made just before the 1939-45 war that the addition of zirconium to magnesium alloys produces exceptionally fine grain-size in the casting, thus increasing both strength and soundness. A number of zirconium-containing alloys have since been developed commercially, the compositions and properties of these alloys being summarized in Table VII.

The first zirconium-containing alloy to appear was Z5Z which contains 4½ per cent. of zinc in addition to a zirconium content of 0.7 per cent. (Technical Bulletins; Millward, 1952). This alloy has good strength-properties in the as-cast condition and these can if necessary be increased by heat-treatment. The alloy has in addition excellent founding characteristics, a low tendency to microporosity, and only a moderate susceptibility to hot-tearing. It is a particular advantage of this material that even in castings of heavy section the mechanical properties tend to be uniform throughout.

Further research led to the discovery that additions of rare-earth elements to magnesium/zirconium alloys were beneficial, particularly in respect of properties at elevated temperatures, and several alloys containing rare-earth elements have been developed. One is RZ5 which has slightly lower mechanical properties than Z5Z but is not so liable to hot-tearing (Technical Bulletins: Millward, 1952; Elektron, 1951). This alloy is intended as a substitute for Z5Z in the manufacture of castings of a design prone to this trouble. Castings can be made pressure-tight in this alloy even more easily than in Z5Z.

Two alloys have been developed for use at elevated temperatures. The alloy MCZ maintains its strength well up to 300 deg. C. and has good resistance to creep at 200 deg. C. (Technical Bulletins: Millward, 1952). As an alternative the zinc-containing alloy ZRE1 (or the similar ZRE0) is satisfactory for use under conditions where creep-resistance up to 250 deg. C. is required. Like RZ5, ZRE1 has excellent founding characteristics and castings in it are almost completely sound and are readily made pressure-tight (Technical Bulletins: Elektron, 1951).

Lately attention has been turned to thorium-bearing magnesium/zirconium alloys and two compositions are now available. One of these, TZ6, has mechanical properties better than Z5Z with casting characteristics as good as those of R5Z (Onitsch-Modl, 1951).

The other thorium-containing alloy, ZT1, is intended for use at elevated temperatures and possesses outstanding creep resistance at temperatures up to 350 deg. C. (Leaflet, 1953; Elektron, 1953). As Fig. 19 shows, the creep rate of ZT1 at 350 deg. C. under a stress of 0.5 tons per sq. in. is of the same order as that of ZRE1 at 250 deg. C. Creep curves obtained from these two alloys at 315 deg. C. are also given in Fig. 19, whence it can be seen that the creep rate of ZT1 at 1.5 tons per sq. in. stress is vastly lower than that of ZRE1 at 0.75 tons per sq. in. It is the manufacturers' recommendation that ZRE1 or MCZ should be used at temperatures up to 250 deg. C., but that where castings have to withstand temperatures between 250 and 350 deg. C. the more expensive ZT1 should be employed.

Research on the properties of zirconium-bearing magnesium alloys is continuing and the properties obtainable from large numbers of experimental compositions are frequently described in the literature. In the United States some variants on the compositions given in Table VI are in use but these do not appear to be superior to the British alloys.

Alloys for Service at High Temperatures

Although a few alloys intended for service at temperatures in excess of about 600 deg. C. had

*Paper presented at the recent general meeting in London of the Institution of Mechanical Engineers. The Authors at the time of preparing the manuscript were, respectively, liaison officer, British Non-Ferrous Metals Research Association; head of melting and casting BNFMRA, and director, S. Russell & Sons, Limited. Mr. Ruddle has since accepted a position in America with the Foundry Services' organization and Mr. Rice is now with Harlow Metal Company, Limited.

† An alphabetical list of references is given in an Appendix to the Paper.

been developed before the 1939-45 war (the Hastelloys), it was not until the advent of the jet engine that an intensive search began for materials capable of operating at 800 deg. C. or higher. As the result of these researches of the last 10 to 15 years, there now exists a very large number of alloys of this kind; a recent publication (Simmons and others, 1955) lists 141 different compositions and it is unlikely that this list is complete. These heat-resisting alloys are of four general types: (1) primarily ferrous alloys containing substantial amounts of nickel and chromium, (2) alloys whose major constituents are chromium, nickel, and cobalt, (3) nickel-base alloys, and (4) cobalt-base alloys. All these alloys contain strengthening additions of other elements. A number of compositions used in the manufacture of castings by the lost-wax or other precision-casting processes are listed in Table VIII.

used for the manufacture of castings (other than on an experimental basis) owing to the great difficulties involved in melting them and in finding a non-reactive moulding material, but it is possible that shaped castings will be made in quantity in the near future.

Minor Developments

In recent years, various minor developments in alloy composition have led to appreciable improvement in the quality of the general run of castings. Perhaps the most important of these advances is that accruing from the better control now exercised over the grain-size of castings. In particular, it has been realized that the grain refinement of light alloys results in castings of higher soundness and reduces the tendency towards hot-tearing in the mould (Cibula, 1952). Furthermore, it has been shown that with some of the high-strength alloys, refinement of the grain markedly alters the shape of the microporosity which is inevitable

TABLE VII.—*Composition and Mechanical Properties of Zirconium-containing Magnesium Alloys.*

Alloy.	Composition.				Condition.	D.T.D. specification.	Specified tensile properties at room temperature.			Endurance limit at 50×10^6 cycles, tons per sq. in.	Tensile strength at elevated temperatures, tons per sq. in.			
	Zinc.	RE.	Thorium.	Zirconium.			0.1 per cent. proof stress tons per sq. in.	Tensile strength, tons per sq. in.	Elongation, per cent.		200 deg. C.	300 deg. C.	350 deg. C.	400 deg. C.
Z5Z ..	4.5	—	—	0.7	As-cast ..	711A	7.8	15.0	10	5.2	—	—	—	—
					Heat-treated	721A	9.8	17.0	7	5.5				
RZ5 ..	4.5	1.3	—	0.7	As-cast ..	738	6.5	12.0	6	5.25	—	—	—	—
					Heat-treated	748	9.0	14.5	5	5.75				
ZRE1 (ZRE0)	2.5*	2.7	—	0.6	Annealed ..	708 (718)	5.5	10.8	5	4.5	8.4	5.5	3.6	—
ZT1 ..	2.5	—	3.0	0.7	Annealed ..	—	6.0	14.0	8	4.5	—	4.8	4.3	3.9
TZ6 ..	5.8	—	1.8	0.7	Heat-treated	—	10.0	18.0	12	5.2	—	—	—	—
MCZ ..	—	3.0	—	0.6	Annealed ..	728	5.7	10.0	6	4.2	8.5	7.1	—	—

* 0.5 in ZRE0. RE Rare earth metals, 50 per cent. cerium.

These alloys are sometimes known as "Superalloys" and they are all characterized by high strength maintained at temperatures up to 800 deg. C. or more. In addition they possess high resistance to creep, fatigue, and oxidation at these temperatures. Table IX gives typical strength properties of the alloys listed in Table VIII. It should be noted that the values quoted in Table IX are representative only and that the properties obtainable from a given alloy may vary considerably with heat-treatment, casting conditions, etc. Further information on these materials can be obtained from Simmons and others (1955), Amer. Soc. Metals (1951), Smith (1950), Symposium (1954), Wiggin (1955), and Simmons and Cross (1954).

Mention must also be made of titanium alloys for service at temperatures up to 600 deg C. Besides possessing good mechanical properties at elevated temperatures, these alloys have an excellent strength: weight ratio. They have not yet been

in many castings in these alloys. Fig. 20 shows micro-sections from castings in aluminium/4½ per cent. copper alloy, that illustrated on the left being fine-grained and that on the right coarse-grained. The total amount of porosity present in each of the two castings was the same. As can be seen, grain-refinement of the structure has converted the angular cavities present in the coarse-grained material into relatively harmless round holes (Cibula and Ruddle, 1949-50).

Copper alloys such as bronzes and gunmetals exhibit a columnar macrostructure when sand-cast from high pouring-temperatures, but at lower pouring-temperatures the structure is equiaxial: equiaxial structures can also be produced by grain-refining techniques (Cibula, 1955). It has recently been established that equiaxial macrostructures are unfavourable from the standpoint of pressure-tightness of these castings and efforts are now made to ensure that columnar structures are developed in castings designed to withstand pressure (Cibula,

1955). Over-heavy machining allowances which result in the removal during machining of the columnar macrostructure are equally harmful.

In addition to these developments, increasing understanding of the undesirable effects of minor impurities and alloying additions has resulted in an all-round improvement in certain alloys. For example, it has been known now for some years that the silicon content of the aluminium/10 per cent. magnesium alloy should be restricted to about 0.15 per cent. if maximum properties are to be achieved (Parker and others, 1947). The phosphorus addition normally made to bronzes and gunmetals for deoxidation purposes can cause gas pick-up from the mould, particularly when added in excess. This fact is now appreciated and steps can be taken to prevent such pick-up when this is necessary (Ruddle, 1954). On the other hand, a moderate pick-up of gas has been shown to be capable of exploitation to produce castings of relatively thin section of improved pressure-tightness (Ruddle, 1954; Buckley and Mantle, 1951). Gas pick-up from the mould also occurs in light alloys containing magnesium in excess of about 1 per cent., and here again methods for controlling this reaction with the mould have been developed (Ruddle, 1954).

TABLE VIII.—*Composition per cent. of a Selection of "Super-alloys" for use at High Temperatures.*

Alloy.	Carbon	Titanium	Chromium	Aluminium	Silicon	Manganese	Iron	Cobalt	Copper	Nickel	Sulphur	Molybdenum	Tungsten	Niobium	Others
Nimonic CC ..	0.15 max.	1.8–2.7	18.0–21.0	0.5–1.8	1.0 max.	1.0 max.	5.0 max.	2.0 max.	—	Balance	—	—	—	—	—
Nimonic CB ..	0.1 max.	1.8–3.0	18.0–21.0	0.8–2.0	1.5 max.	1.0 max.	5.0 max.	15.0–21.0	—	Balance	—	—	—	—	—
Nimonic C75 ..	0.08–0.15	0.2–0.6	18.0–21.0	—	1.0 max.	1.0 max.	5.0 max.	—	0.5 max.	Balance	—	—	—	—	—
N-155 (low C)	0.2 max.	—	20.0–22.0	—	0.6 max.	1.0–2.0	—	18.0–22.0	—	18.0–22.0	0.04 max.	2.50–3.25	2.0–3.0	0.75–1.25	0.08–0.116N
HS21 (Vitallium)	0.20–0.35	—	25.0–30.0	—	—	—	2.0 max.	Balance	—	1.50–3.50	—	—	—	—	—
HS31 (X-40) ..	0.40–0.60	—	23.0–28.0	—	—	—	2.0 max.	Balance	—	9.0–12.0	—	—	6.0–9.0	—	—
S-590	0.40	—	20	—	0.7	1.5	24	20	—	20	—	4.0	4.0	4.0	—
S-816	0.38	—	20	—	0.7	1.5	3	43	—	20	—	4.0	4.0	4.0	—
GMR-235 ..	0.15	2.0	15.5	3.0	0.60	0.25	10	—	—	Balance	—	5.25	—	—	0.05B
GE-B-129 ..	0.05	—	5	6.0	0.40	0.40	4	—	—	65	—	15	—	2	0.5B
I-1360 ..	0.10	—	10	6.0	—	—	—	—	—	70.5	—	5	—	2	—
HS23	0.40	—	24	—	0.60	0.30	1.0	66	—	32	—	—	6	—	—
HS27	0.40	—	25	—	0.60	0.30	1.0	34	—	32	—	6	—	—	—
HS30	0.40	—	24	—	0.60	0.60	1.0	51	—	16	—	6	—	—	—
HS36	0.40	—	19	—	0.50	1.2	1.0	55	—	10	—	—	8	—	0.03B
X-50	0.76	—	22.5	—	0.50	0.60	2.5	40	—	20	—	—	12	—	—
X-63	0.40	—	23	—	—	—	1.0	58	—	10	—	6	—	—	—
HE1049 ..	0.40	—	26	—	0.8	0.8	3.0	Balance	—	10	—	—	15	—	0.40B

Standardization

At present there is a very large number of different alloy-compositions available to the engineer. British Standard and Aircraft Specifications list 32 copper and 38 aluminium casting-alloys, and numerous other non-standard compositions are often insisted upon by consumers. There seems little doubt that the number of alloys at present in general use is considerably greater than necessary and it is noteworthy that a committee of the Institute of British Foundrymen has recently concluded that the number of standard alloys could be reduced with advantage. Particularizing, the committee suggest that seven alloys be omitted from B.S. 1400. In a great many cases, the non-standard alloys could be replaced by alloys listed in the British Standard Specifications without any disadvantage to the engineer. In recent years, some organizations have rationalized considerably the variety of materials they use, for example, British Railways have reduced the number of copper-base alloys used in their workshops from 37 to 5. But there nevertheless remain numerous bodies both public and private, which could go much further in this direction. A few years ago, one of the authors visited a bronze foundry where he was told that in the course of a single year over 200 different alloys were handled. Reduction of the number of alloys in general use to a reasonable figure, say, 15 or 20, can bring about valuable economies—the IBF committee consider that increased productivity and decreased prices would follow—and it is suggested that engineers can help in this direction by specifying British Standard alloys and by taking the advice of their suppliers with regard to the best alloy to use for a given casting.

Developments in the Manufacture of Castings

Inspection of Castings

The reliability of castings is continually being increased by improvements in inspection methods; in particular the increased use of radiography and by its extension to thicker sections owing to the introduction of gamma-ray techniques using radioactive isotopes. The use of ultrasonics as a method of crack-detection has also been developed to some extent. One interesting development on these lines is worthy of special mention. This so-called "sonic" method of detection (Diamond, 1956) is really a modern development of the age-old technique of testing a casting by listening to its ring when tapped with a hammer. In the present application, the casting is mounted on a sounding board and struck with a mallet or by a steel ball activated by compressed air. The sound waves produced are converted into electrical energy by a transducer, amplified and analysed into component frequencies by an electronic device. The frequencies observed indicate whether the casting is defective or not. It is interesting to note that in one version of the device acceptance or rejection of the casting is entirely automatic; if accepted it is automatically passed into a paint-spraying machine, otherwise it it conveyed back to the foundry. The sonic tester is thus an inspection device which requires no inspector, not even a labourer.

FUTURE TRENDS

Although detailed forecasting of future developments in the foundry industry is impossible, certain general trends can be discerned and reasonable short-term predictions made with some confidence, although with the necessary qualification that all predictions can be upset by fresh discoveries.

Process Development

It seems likely that the present shortage of skilled moulders will become aggravated in the future and it will become increasingly important that their efforts should be utilized to the best advantage. This, together with the general tendency toward mass production, will result in a steady extension of mechanization in the foundry, such mechanization taking three forms:

(1) Machines, for example, moulding machines, at present worked by semi-skilled labour, will tend to become fully automatic.

(2) Machines which at present operate independently will tend to be linked.

(3) Power aids will be provided for jobs still requiring manual skill.

The need to economize in skilled labour is likely

TABLE IX.—*Mechanical Properties of Alloys Listed in Table VIII.*

Alloy.	Room temperature tensile properties.			Properties at elevated temperatures.				
				Tensile properties at 900 deg. C.			Stress, tons per sq. in., required to produce creep rate of 0.0001 per cent. per hour at 815 deg. C.	Stress, tons per sq. in., required to produce rupture in 1,000 hours at 815 deg. C.
	0.1 per cent. proof stress, tons per sq. in.	Tensile strength, tons per sq. in.	Elongation, per cent.	0.1 per cent. proof stress, tons per sq. in.	Tensile strength, tons per sq. in.	Elongation, per cent.		
S-590	33‡	62	24	14‡	16	24	4.9	7.1
S-816	38‡	65	34	14‡	20	17	4.9	8.0
GMR-235								12.9
GE-B-129								12.9
I-1360								12.2
HS23		49	9		20*	10*		9.7
HS27		40	12		18*	11		8.2
HS30		42	10		22*	9		9.7
HS36		45	5		27	6		11.4
X-50								9.8
X-63								7.9
HE1049								15.6
Nimonic CC†	39	69	39	12	15	26	3.1§	8.0§
Nimonic CB†	50	76	33	12	15	31	3.4	5.6
Nimonic C75†	22‡	52	44	3.5	7	80	—	—
N-155 (low C)†	25‡	53	41	10‡	13	34	4.0	5.8
Haynes No. 21 (Vitallium)	37‡	48	4	13‡	21	25	4.0	6.5
Haynes No. 31 (X-4)	45‡	58	8	16‡	21	20	7.8	10.5

In all cases materials in fully heat-treated or aged conditions.

* Property at 871 deg. C.
† Determined on wrought material; properties of cast alloy may be lower, especially elongation at room temperature.
‡ 0.2 per cent. proof stress. § At 750 deg. C.

to promote the use of die-casting as opposed to sand casting, especially in the case of alloys of high melting-point which are not at present die-cast extensively. The higher dimensional-accuracy, better mechanical-properties and superior surface-finish of die-castings all favour this trend.

The CO_2 process, which also makes less demands on the skill of the moulder, is likely to forge ahead, particularly in the production of cores and of large moulds. Indeed, several foundries have already largely abandoned the manufacture of cores by conventional oil-sand methods. The use of the shell-moulding process will doubtless also increase, but economic considerations may well restrict this process to long runs of castings, where savings in machining time are substantial.

Coupled with the development of these new processes, simplification of casting design and increased use of work-study must ensure that the skilled man devotes the whole of his time to work in which his capabilities are fully utilized, with commensurate financial reward.

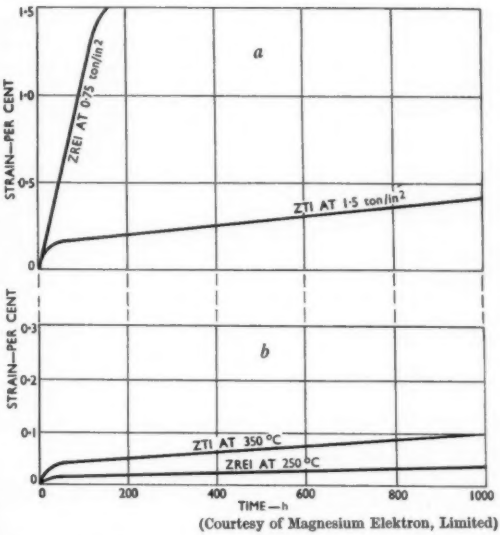
Despite the advent of mechanization and automation in repetition founding, the jobbing foundry will nevertheless still have a large part to play, and will not only have need in the foreseeable future for skilled craftsmen but will require to back their manual dexterity by an adequate standard of technical and scientific training and by the provision of power aids and other mechanical devices. The jobbing foundry has so far lagged behind in the latter respect and great scope exists for the increased use of overhead sand supply to a small number of moulding points serviced by simpler versions of the impeller-type sand rammer and for conveyors to take the finished moulds to the casting line.

Moulding and Casting Developments

It is reasonable to expect that an expansion of central technical planning in the foundry will take place to ensure that less is left to the whim of the individual moulder in the matter of gating, feeding, and other aspects of moulding practice. These subjects will increasingly come under the control of a qualified technologist, responsible for ensuring that the results of research on such subjects are speedily adopted.

Continuing research on the gating of castings should enable the foundryman to ensure that his moulds are filled with the minimum of agitation, so reducing the incidence of dross and non-metallic inclusions. Similarly, investigations on feeding techniques should permit him to determine the best possible location and size of the feeders, chills, etc., to be employed. Naturally the decision as to the feeding method to be employed will be governed partly by economic considerations which will not always justify the use of the technically ideal methods. However, in the future the foundryman should need to rely less on past experience and intelligent guesswork and more on the use of data scientifically arrived at.

The trend in all foundry moulding processes is toward improvements in surface-finish and dimensional-accuracy which will reduce or eliminate post-foundry operations such as machining and polishing. Higher quality of castings is also likely to result from the increased use of non-destructive testing methods including radiography and various physical crack-detection methods.



(Courtesy of Magnesium Elektron, Limited)

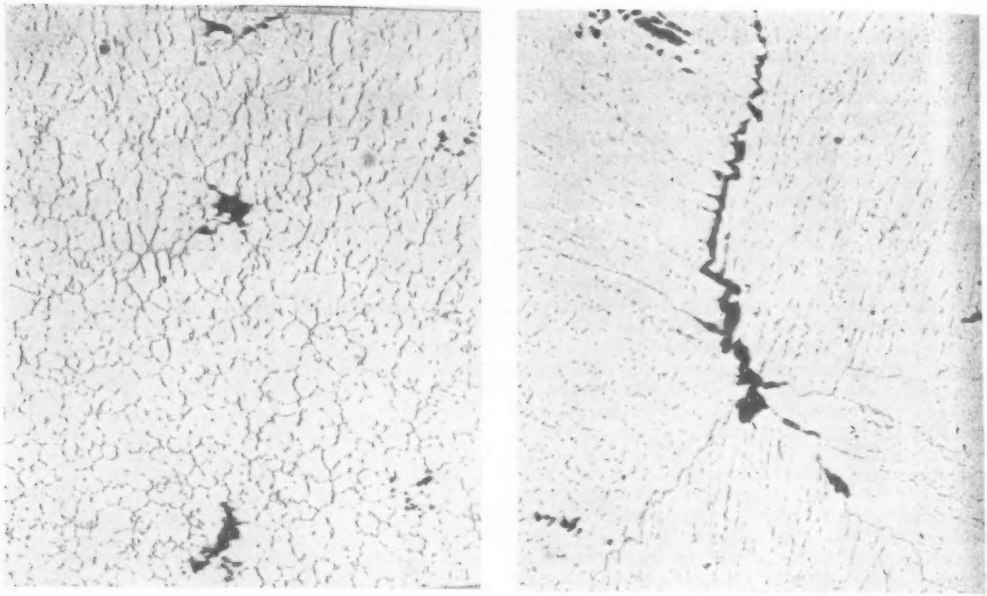
FIG. 19.—*Creep curves for ZT1 and ZRE1 magnesium alloys.*

Key: (*a*) At 315 deg. C.; ZT1 stress 1.5 tons per sq. in.; ZRE1 stress 0.75 ton per sq. in.
(*b*) At 0.5 ton per sq. in.; ZT1 test temperature 350 deg. C.; ZRE1 test temperature 250 deg. C.

Alloy Development

Where aluminium and copper alloys are concerned, the future is likely to see a steady improvement in properties rather than the development of new alloys of markedly improved properties (although this cannot be ruled out). The history of magnesium alloys has just passed through such a period in which a completely new group of alloys of much enhanced properties has been introduced and it is likely that here, too, development will settle down to the steady improvement of the existing alloys. The development of satisfactory melting and casting techniques for titanium alloys presents big problems but it seems reasonable to hope that solutions of these will not be long delayed.

The discovery of spheroidal-graphite cast iron has revolutionized the scope of the cast-iron industry. Here again, the immediate future is likely to be one in which the recently developed alloys are consolidated and new modifications developed designed principally to supplant the use of steel. Improvements in the mechanical properties of the flake-graphite grey-irons are likely to be less marked.



(Courtesy, Institute of Metals)

FIG. 20.—*Distribution of voids in test-bars of aluminium/4.5 per cent. copper alloy; (left) grain-size 0.25 mm., voids 0.8 per cent.; (right) grain size 4 mm., voids 0.8 per cent.; both* ×20 *magnifications.*

Developments in Melting Technique

Spectacular developments in this field also seem unlikely and it is probable that future developments will consist mainly of a steady tightening of control over the conditions in which melting is conducted. The expectation is that alloys will be produced to closer composition limits, that their gas contents will be more strictly governed, that improved fluxing and other techniques will lead to the production of cleaner metal and that pouring temperatures will be more accurately controlled. Certain of these developments may necessitate the development of new and better instruments for measuring gas-content, temperature, etc.

It is likely that increasing use will be made of vacuum techniques when the highest properties are imperative in the casting. The vacuum techniques available include vacuum degassing in which the metal is melted in the ordinary way but subsequently placed in an evacuated enclosure for removal of gas-vacuum casting in which the casting operation is conducted in an evacuated enclosure, and full vacuum melting in which both melting and casting are done *in vacuo*. The ability of these processes to produce castings of low gas-content free from inclusions has already been demonstrated and is already being employed on an increasing scale with some alloys.

The importance of grain-size and macrostructure is now fairly generally realized and it seems certain that more attention will in future be paid to governing these factors both by methods of metal treatment and by control of the properties of the mould.

Electric power for melting is becoming increasingly attractive economically compared with other fuels and it is probable that the economic balance will be increasingly in favour of electric melting if the hopes pinned on the development of atomic energy are fulfilled. This, combined with the metallurgical advantages of electric melting, is likely to ensure that an increasing proportion of the total foundry output is melted by this means.

APPENDIX

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"Confusion worse confounded" results when corrections are improperly made and this happens sometimes even in foundries, as for instance when a "patch" inserted to repair a mould may be accidently dislodged and, falling into the cavity, become absorbed into the casting with disastrous final effect. Much the same sort of thing can happen when correcting printers' proofs when an error in type is marked for correction and in effecting one amendment further errors are perpetrated. An example of this was in the JOURNAL of December 5, where in the caption to Fig. 5(a) on page 672, what was first set in type as "Langally aB" became, after improper correction, "Langally 3B," although the correct title should be "Langalloy 3V." This trade name applies to an 18/8/3 Mo type of stainless-steel alloy produced by Langley Alloys, Limited. For the mistake in the JOURNAL apologies are tendered to the company, to readers and to the authors of the paper in question.

Influenza Affected Industrial Output

Influenza accounted for a slightly lower index of industrial output in October than had been expected. Increases over 1956 of 3 per cent. in August and 2 per cent. in September were not maintained in October, when output was at most 1½ per cent., and possibly under 1 per cent. higher than a year ago.

The index (1948 = 100), adjusted to exclude movements due to regularly recurring seasonal factors, stood at 136 in January (138 in January, 1956), rose to 142 in June (138), and in succeeding months dropped to 140 (137) in September and 137-138 (136) in October.

Estimates for individual industries indicate that by comparison with October, 1956, last month's output was substantially lower in the building industry (bricks and cement) and deep-mined coal. Steel output was 4½ per cent., motor-car output 26 per cent., and commercial vehicle output 20 per cent. higher, and about 5½ per cent. more electricity was generated.

Newton, Chambers/Ransomes/Rapier: Merger Talks

Negotiations for an amalgamation of the interests of the two companies are in progress between the boards of Newton, Chambers & Company, Limited, ironfounders, manufacturers of blast-furnace, steelworks, chemical and by-products plant, etc., of Thorncliffe, near Sheffield, and Ransomes & Rapier, Limited, engineers and ironfounders, manufacturers of cranes, excavators, etc., of Ipswich.

The boards state that it cannot at present be forecast whether the negotiations will be brought to a successful conclusion. As soon as any conclusions are reached, shareholders will be informed. In the meantime they are advised not to dispose of their holdings.

Newton, Chambers & Company has an issued capital of £2,000,000, all in £1 ordinary shares, while Ransomes & Rapier has an issued capital of £814,000, including £684,000 in 10s. ordinary shares.

Notes from the Branches

Australia (Victoria)

The Australian branch (Victoria) of the Institute of British Foundrymen, held its fifth annual convention in Melbourne, from November 19 to 22. It was opened by Sir Ian Clunies Ross, C.M.G., D.V.SC., chairman of the Commonwealth Scientific and Industrial Research Organization. Four sessions were devoted to the discussion of papers and to general business, and one session took the form of a whole-day visit to the works of M. B. John & Hattersley (Pty.), Limited, Ballarat. The conference concluded with the annual banquet at Ascot House. The complete programme was as follows: On Tuesday, November 19, members assembled at 2.30 p.m. for session 1 in the Radio School Theatre of the Royal Melbourne Technical College. At 3.00 p.m. was the official opening of the convention; at 3.30 p.m. a break for afternoon tea and at 4.00 p.m. the annual meeting of the branch and presidential address, followed at 6.00 p.m. by a fellowship tea in the restaurant of the Royal Melbourne Technical College.

Session 2 was held in the Engineering School of the University of Melbourne, and began at 7.30 p.m. with the exchange paper from the Institute of British Foundrymen, entitled "The CO_2 Process and the Reasons Why," by A. Kirkham. Later, an exchange paper from the Institute of Australian Foundrymen, N.S.W. Division: "An Introduction to Refractories," by C. Becker concluded that day's programme.

On the Wednesday, session 3 in the Metallurgy School of the Royal Melbourne Technical College commenced at 7.30 p.m. with "The Production of Precision Patterns," by C. Sleeman, followed at 8.30 p.m. by "Coreblowing," by W. Gibson. Then on the Thursday was the works visit to Ballarat and on November 22, session 5 was held in the Radio School Theatre of the Technical College. The morning of this day was taken up by the exchange paper from the American Foundrymen's Society: "Recollection of 54 years in the Foundry Industry," by C. R. Mann and, to conclude the technical contributions, the exchange paper from the Institute of Indian Foundrymen entitled "Foundries in India, their Scope and Future," by Arjan Vaswani. The afternoon was free for members to prepare for the annual banquet which commenced at 6.15 p.m. Dress was informal and members had been invited to take along friends to this function as well as to the rest of the function.

Birmingham

The November meeting of the Birmingham branch was held at the James Watt Memorial Institute, when Mr. B. N. S. Perry, B.SC., of G. Perry & Sons, Limited, Leicester, presented a paper entitled "Production Pattern-equipment for some Typical Automotive Castings." The author commenced by saying that he would deal with the pattern equipment necessary for casting a cylinder-block and cylinder-head, two well-known types of casting for which a good deal of forethought was required. He pointed out that accurate drawing and planning were essential, and that special attention must be paid to core spread and core-rubbing allowances. Although cylinder-blocks and heads were most intricate castings, there had not been much radical change in design in the last 35 years. Important factors which had to be taken into account at the planning stage were the size of the moulding box, the type of moulding machine available, coreblowers, the runner system, rate of production required, etc.

By means of an excellent series of slides, Mr. Perry then outlined the constructional patternwork necessary for making cores for a cylinder-block, and went on to explain that due to the complicated build-up of both the crankcase and water-jacket cores it was necessary to have either a sliding side to the moulding box—which was not very practicable—or to use a fixture to build up the core, and to transfer the core to the moulding box by means of a transfer cage. The latter method was the one generally adopted and was quite satisfactory, especially when unskilled labour was employed. He then showed some core rubbing boxes for treating cores where extremely close tolerances were required. The assembly of cores for cylinder-heads was next dealt with, and in this instance, the cores were built on a base core and then by means of a fixture transferred to the mould. The lecture was concluded by the showing of a series of slides illustrating gauges for checking castings.

In proposing the vote of thanks, Mr. Clarke said that Mr. Perry had greatly benefited members present by showing them the many details of his work, and they had perhaps witnessed an approach to perfection in pattern and corebox equipment. Mr. Wrightson, in seconding the proposition, stressed the practical nature of Mr. Perry's contribution and concluded by praising the quality of the illustrations.

Coventry Section

The first social function ever to be organized by the Coventry section of the Birmingham branch was held under the chairmanship of Mr. A. H. Pendleton at the Hotel Leofric. The speakers were, in addition to the chairman, Alderman Harry Weston, Mr. T. Player, and Mr. J. Blakiston. At the high table were Mr. V. C. Faulkner, Mr. G. Lambert, Mr. J. W. Dews, Mr. T. Weaver, Mr. W. R. Marsland, and Mr D. F. Bailey, most of whom were accompanied by their ladies. Alderman Weston staged an interesting exhibit of mediæval stone moulds and castings loaned from the local museum. The function was well staged and so obviously popular that it is certain to be the first of an annual fixture.

New Catalogues

Dust Collection. In publication No. 72, W. C. Holmes & Company, Limited, Turnbridge, Huddersfield, briefly describe and illustrate their range of dust-collecting and control plant. Four types are dealt with, which will cover the majority of industrial atmosphere-pollution problems.

Steel Band Conveyors. Sandvik Steel Band Conveyors, Limited, Dawlish Road Works, Selly Oak, Birmingham, 29, have issued a leaflet covering the potentialities of "Tru-track" conveyors for handling a variety of materials. A major feature of the design is the assurance of true alignment through the use of a vee-rope drive beneath the steel band.

Clean-air Apparatus. Air Control Installations, Limited, Ruislip, Middlesex, in publication No. B 5713, describe and illustrate a method of cleaning air. It is based on the agglomeration of minute particles or dust by an electrostatic method; these enlarged particles are carried to and adhere to a filter curtain, or curtains, operated on similar lines to a film in a camera, and the changing of these is claimed to be likewise as simple. The system is known as "Rollotron." The curtains are 65-ft. long but, when rolled on to the bottom spool, only measure 13-in. dia., and are thrown away after use.

New Light on the "Coal Situation"

By Francis D. Roper, C.G.I.A.

At the outset it should be made clear that this article has no reference to present-day matters, but is an enquiry into the truth of the generally accepted statement that Dud Dudley was the first man successfully to use coal as fuel for the purpose of smelting iron. In this statement, "successfully" is the operative word, for it infers that others before Dudley had made attempts at using coal as fuel, and it also infers that any such attempts had not been wholly successful. A brief review of the facts as now known is as follows:

Prior to about 1610, the fuel used for smelting iron was charcoal, which, although producing a satisfactory result was most uneconomical—first because the amounts of fuel required were considerable, and secondly because such large quantities of fuel resulted in the destruction of great areas of forest land with a consequent threat of shortage of suitable timber for other purposes, particularly shipbuilding. In view of these two difficulties, efforts were apparently being made to utilize coal instead of charcoal, and in 1611 Simon Sturtevant was granted Patent rights covering this process. Whether or not Sturtevant ever actually smelted iron with coal is difficult to say, but in 1612 the Patent rights granted to him were cancelled and the privilege passed on to John Rovenson (or Robinson) for a period of 31 years. Dudley's Patent was not granted until 1619*, and in the intervening six or seven years, at least two others (Gombleton and Dr. Jordan) had been granted Patents appertaining to the smelting of iron with coal, but as Rovenson's Patent still held good and had not been cancelled or revoked, it is reasonable to assume that the Patents of Gombleton and Dr. Jordan were based on some modification of Rovenson's process. From 1619 onwards, Dudley states that he was very successful with his process, and in 1620, at the King's command, he sent "... much good merchantable iron unto the Tower, to be tryed by all artists, and they did very well approve the iron." How then, had Dudley succeeded where others had failed, and, more important, what was Rovenson doing in the meantime? In order to answer the first part of the question, the implications of the term "coal" as applied to the process of smelting must be considered.

Manner of Use

In modern iron-smelting, all are aware that coke is the chief fuel used, hence one may say: "Iron is produced from the ore by smelting in a suitable furnace, the fuel used being coke," or in a more condensed form "Coke is the fuel used to produce iron." However, it is also known that coke is produced from coal by a process of partial combustion, so it is therefore correct to say "Iron is produced from the ore by smelting in a suitable furnace, the fuel used being processed coal," or "Coal is the fuel used to produce iron." What must now be decided is the form in which Dud Dudley used coal for smelting purposes—did he charge it into the furnace as "raw coal" or was it first processed into a form of coke? Unfortunately there is no specific information available about this, but a significant fact emerges from a perusal of Rovenson's "Treatise of Metallica." In this work, Rovenson explained that his Patent rights covered the production of hot water, and that he planned to do this by the simple expedient of utilizing either the waste heat of the products of combustion, or the radiated heat of the furnace in which he would be smelting iron. He foresaw an entirely new type of vessel fitted with a removable top and a long spout. The purpose of this vessel was two-fold—it could be filled with water, placed on or near the fire, and the heated water run off through the spout as required, *or*, the vessel being filed with water, the top was luted on, and, "... as the vessel heateth and the water evaporateth by the spout, it maketh a continual blast to kindle or increase the fire in the furnace." In other words, Rovenson planned to blow the furnace with a jet of steam instead of the normal blast of air delivered by bellows. If at some time or other Rovenson tried out this particular device, instead of blowing up the fire as he had anticipated, he would only have succeeded in putting it out; moreover, the partially-burned coals which were left in the grate would quite naturally have been converted into a type of coke. Thus this quite acidental discovery could have provided Rovenson with vital information which he would naturally have attempted to exploit more fully.

Dud Dudley's Rôle

Where Dud Dudley enters the "picture" will next be examined. Dud was the son of Edward Lord Dudley, well-known at the time as a landowner, colliery-owner, and iron-master, who, operating a number of furnaces and forges in the immediate district of Pensnett, Cradley, Stourbridge and the like. Young Dud was sent to Balliol College at Oxford, but before he had completed his studies there he was required by his father to return home, ostensibly for the purpose of taking over the management of three of Lord Dudley's ironworks in Pensnett.

The date was early 1619 and Dud was then 20 years of age. It seems that the "vacancy" arose from a difference of opinion between Lord Dudley and his furnace manager, the outcome of which was that the said manager should terminate his employment with the Earl in three-months' time. Oddly enough, the furnace manager was none other than John Robinson (or Rovenson), so it is pretty evident that Rovenson, with the facilities provided by the

* Actually this Patent was transferred, by agreement, from John Rovenson (or Robinson) to Dud's father, Edward Lord Dudley. Dud Dudley's own Patent was granted in 1639.

New Light on the "Coal Situation"

Earl, had been exploiting his discovery. It is also fairly obvious that the process of smelting iron with coal was by then becoming well understood, for events moved in rapid succession. In the short space of less than six months all of the following happened: (1) Dud Dudley returned home from college and immediately made two successful "trials." (2) On the strength of his second "trial," Lord Dudley applied to the King to be granted the Patent rights for the process and the King granted the Patent (March 1619). (3) By agreement between Edward Lord Dudley and John Robinson (or Rovenson), the Patent rights originally granted to Robinson were transferred (May 1619) in full to Edward Lord Dudley, part of the agreement being that Lord Dudley should pay to Robinson a "royalty" of four shillings for every ton of iron produced by the process.

Still Some Doubts

Such are the facts. The reader is now left to decide for himself: (*a*) Did Rovenson ever succeed in smelting iron with coal? (*b*) Did Rovenson impart the secret to Edward Lord Dudley? (*c*) In providing money, facilities and equipment, was Edward Lord Dudley instrumental in furthering the process, *or*, was Edward Lord Dudley, by observing Rovenson's technique able to improve and perfect the process? (*d*) *Was* Dud Dudley the first man successfully to smelt iron using coal as fuel?

Cast-iron Satellite of 1790

By C. J. Robb

Man has always been attracted by the moon and his many inventions down the ages have included numbers of lunar devices. The clockmaker of the 18th century made many lunar-phase clocks with painted ruddy moons moving by the clock-train within the dial arch.

In the last decade of that century a Dublin ironfounder made a great artificial moon in cast iron for the Duke of Leinster and this was mounted on a cast-iron pillar of slender dimensions as a moonlight-garden ornament at his seat, Carton Castle. This satellite was 4-ft. dia., having the features of the moon marked on its surface and was covered with gold leaf, a most beautiful golden ball.

It was so raised above a clump of shrubbery that on moonlit nights it shone like the moon itself in the garden landscape and, in its turn, was considered a wonder—perhaps no less than the Russian satellite is to-day. The founder was a Mr. William Clarke and the gold-covering to reflect the lunar rays was done, it is related, by Mr. George Barton.

LOCAL UNDER-EMPLOYMENT in iron foundries had been arrested and full-time working resumed, it was stated in a report submitted to the Wolverhampton Employment Committee on December 3 by its secretary, Mr. I. Holliday. Demands for skilled and semi-skilled labour continued at a good level and in Wolverhampton now there were slightly fewer than 240 men unemployed. The future employment position appears favourable.

UK Business in Foundry Equipment

According to the Board of Trade, the foundry equipment industry, during the third quarter of this year, exported £201,000 of goods and in the home market sold further goods to the value of £1,014,000. The breakdown of these figures is shown in Table I.

TABLE I.—*Summary of Returns made to the Board of Trade by Firms Manufacturing Foundry Equipment (No. of Returns 49) (figures to £1,000).*

Type of equipment.	Deliveries during July to September, 1957.		
	For export.	For other orders.	Total.
Sand-preparing machines (*i.e.*, mills, disintegrators, etc.)	23	203	226
Moulding machines and moulding boxes	61	266	327
Sand-blast plant	52	201	252
Melting equipment (including ladles)	17	94	111
Coremaking machines, plant and accessories	5	64	68
Other equipment including chaplets and studs, but excluding mechanical-handling plant or mechanization and materials such as abrasives, etc.	44	186	230
TOTAL	201	1,014	1,215

NOTES.

Goods which are only merchanted or factored are excluded.

The figures in the columns:—

"*For export*" include only direct exports and supplies known to be destined for export through merchants or shipping houses.

"*For other orders*" include supplies to Government Departments, local authorities, the National Coal Board, British Railways and other public utility undertakings, the Channel Islands and the general home trade.

The figures have been rounded off to the nearest final digit and there may be an apparent slight discrepancy between the sums of the constituent items and the totals shown.

From this table it is possible to state that the home market sales were above the average for the similar period last year, whilst exports were below the 1956 mean figures.

BR Demurrage Charges Revised

The charges made by British Railways to traders for the detention of wagons and containers beyond the "free" period (basically one clear day) allowed for loading and unloading, are to be increased from Monday, January 6, 1958. These charges, which have remained unaltered since 1939, are at present (with certain exceptions) 6s. per wagon or container per day after the initial free period. They will now be raised (again with certain exceptions) to 9s. per day for ordinary wagons and containers for the first two days after the free period, and to 18s. per day thereafter. Charges for special wagons and containers will be increased by broadly comparable amounts. Despite these increases, British Railways demurrage charges will still be the lowest made by any major railway administration in the world.

Latest Foundry Statistics

Steelfounding. The number of people engaged in steelfounding on October 5 was, according to the statistical *Bulletin* issued by the Iron & Steel Board and the British Iron and Steel Federation, 20,090. This was 360 fewer than a month earlier and 350 fewer than a year ago. On the other hand, the average weekly production of steel castings during October was estimated at 7,400 tons. This compares with 7,100 and 7,200 tons in September and October 1956, both still estimated.

When is Commission Due?

By Lord Meston

Is a traveller entitled to payment of any commission after his direct connection with a foundry or supply firm has come to an end? It would be convenient to be in a position to answer "Yes" or "No" to this question and thereby avoid controversy. Unfortunately a direct answer cannot be given, as everything may turn upon the actual terms of the agreement under which the representative was employed.

In some cases an agent enters into a carefully written agreement with his principal. The agreement is probably examined and corrected, if necessary, by the legal advisers of both parties. The agreement as thus prepared usually deals, amongst other matters, with the remuneration of the agent in some detail. With "travellers," however—using that term in a colloquial sense—there is not always the same degree of formality between them and their principals. Sometimes agreements for the employment of travellers are made in an exchange of letters, and sometimes even by word of mouth and it is not often that a precise legal document is drawn up.

Alternative Terms

As to whether an agent—and this term, of course, includes the "traveller" or commercial representative—is entitled to any commission after his agency is ended, is a question which must be considered in stages. The first rule is that an agent can only claim remuneration on transactions which are the direct consequence of his agency. It is not necessary for the agent actually to complete a transaction, but he must show that his intervention was "the effective cause" in bringing about the transaction between the principal and the third party.

In the normal course of events an agent's right to remuneration ceases when his agency comes to an end. The parties, however, may expressly stipulate that the principal shall be liable to pay commission upon orders sent by a customer originally introduced to the principal by an agent even after the latter has ceased to represent the principal.

When investigating such circumstances, in every case, the first thing to do is to find out what are the precise terms of the agency agreement. It may be that there exists a single formal document setting out the terms of that agreement. There may be no such formal document but instead a number of letters passing between the parties, which in fact constitute an agreement. Again, there may be nothing in writing at all, and in that case if a dispute arises it becomes simply a matter of sifting evidence to decide as to what was in the minds of the contracting parties at the time of engagement.

It will be appreciated that nothing can be decided one way or the other unless and until the precise terms of an agency agreement are ascertained. Having discovered this precise agreement between the parties, then it depends on the construction of the agreement as to when the agent's remuneration should cease.

Practical Examples

To illustrate what can happen where there is a dispute, the following actual cases are cited, though, of course, the parties concerned must remain anonymous: In the first litigation, a principal engaged a commercial traveller on a salary and commission on all business obtained by the agent, including repeat orders from all firms in the territory allotted to him, it being stipulated that the agent was to have the commission on all accounts that he opened, including all repeat orders, whether they were actually handed to the agent or posted direct to the principal. Three years later, the agent left the principal's service, and the principal refused to pay the agent commission on orders received after the actual date on which his employment terminated from customers introduced by the agent to the principal. The Court found that, on the construction of the agreement, it was clear that the parties contemplated payment of the commission earned only during the continuance of the agreement.

Period Limited

In a second case, the principals, who were the proprietors of a daily newspaper, engaged a man as their canvasser to obtain advertisements for the newspaper on terms that he should receive 10 per cent. on all renewal business for such advertisements as were placed by advertisers introduced by him, and that he should receive 10 per cent. on all renewal orders of such advertisements, so long as they were sent in within one year of the next previous order, whether sent through the canvasser or direct to the newspaper. Later, the proprietors of the newspaper gave the canvasser six-months' notice to terminate the agreement, and refused to pay commission on any orders or renewal orders for advertisements that did not appear in their newspapers before the date when the agreement terminated. The canvasser claimed that he was entitled to be paid commission on renewals of advertisements which had been introduced by him subsequent to the date of the termination of his agreement. The Court found that the period within which renewals of advertisements must be obtained to entitle the canvasser to commission was one year, and there was no express arrangement in respect of advertisements after the termination of the canvasser's employment. Therefore the canvasser was not entitled to anything more than the proprietors of the newspaper were willing to give him—that was, commission on certain running advertisements.

When is Commission Due?

Other Cases

Where an agreement is "silent" as to what is to happen about remuneration after the termination of the agreement, one might be tempted to think that silence implies that no remuneration is payable after the traveller has ceased to represent his principal. Such silence, however, is not conclusive one way or the other. In a third case, a traveller was employed to sell goods on commission, and the principals agreed "to allow him commission upon all orders executed by them and paid for by the customers arising from his introduction." It was held that the agent was entitled to commission on all orders from customers introduced by him, even if the orders were received after the agent had been dismissed from his principals' employment. There was an agreement to pay commission on all accounts introduced by the agent, so long as the principals continued to do business with the persons he placed on their books. It was also held that the commission continued to be payable to the agent's executors after his death.

In yet another case, the principal agreed with the agent as follows:—"I agree to pay you half profits on receipts of orders (provided the customer is good). Same applies to repeats on any accounts introduced by you." The agent obtained and transmitted orders to the principal under that agreement. Later, disputes arose between the parties, and the principal terminated the agreement without giving any notice. The Court held that under the agreement the agent was entitled to commission on orders whenever received if they came from customers who had been introduced by the agent. It will be noted that in this case the agreement was for an indefinite term, and, notwithstanding the ending of the agreement, the agent was entitled to commission on orders whenever received if they came from customers introduced by him.

Desirability of Prior Clarification

In order that there should be no misunderstanding on the matter, a traveller who wants to draw commission on "repeat" orders after the termination of the agency agreement should ask his principal to insert a clause in the agreement to that effect. Whether or not the principal agrees to do so is another matter. On the other hand, if a principal does not want to pay his agent commission after the termination of the agency he should make it clear in writing in the agency agreement that no commission or other remuneration is payable after the termination of the agency agreement, whether such agreement be terminated by notice or otherwise.

Needless to say, a principal must always pay commission which has already accrued due before the termination of the agency agreement but which may not have actually been paid at the date of the termination of the agreement.

American Letter

More Scrap in Castings

In the United States, steel orders coming in at less than current production rates drive producers to make sales or face the need to lower production (steel production at about 70 per cent. of capacity may slip lower and competition with imported steel at lower prices is increasing). The situation affects foundry procedures to the extent that offerings of scrap increase and prices for scrap weaken. Since prices of pig-iron remain firm, foundrymen turn to the use of more scrap in their mixtures. Concurrently, as more scrap goes into castings production, a pig-iron surplus builds up.

Canadian Copper and Nickel Output

The Bureau of Statistics (Canadian) reports totals for the first nine months of 1957 (nine months 1956 in parentheses) as:

	(short tons of 2,000 lb.)
Copper	(264,898) 254,200 — Down 4 per cent
Nickel	(133,914) 143,123 — Up 7 per cent

Machine Tools Slow Up in US

Machine-tool markets, an important factor in foundry operations, extended their year-long decline and established a new "low" since 1950 in terms of incoming orders. Over 1957 to date, business has decreased to about 60 per cent. of the 1956 rate and prospects are that 1958 will not fare better. Shorter working weeks and some "lay-offs" have been necessary in coping with the recession.

Slump in Farm Equipment

Farm machinery provides an important portion of casting markets and the steady six-year decrease in American sales has reached a low level in 1956 sales that had not been equalled for nine years. Sales were at a record 2.3 billion dollar rate in 1951 and declined by 30 per cent. to 1.7 billion dollars in 1956. Acreage curbs and lowered farm incomes have been quoted as the principal causes. Rates for 1957 are steady but no better. Farm-machinery manufacturers have closed inefficient plants, turned others into producing marine motors, baby "buggies," fertilizer, etc., while stimulating their sales channels toward improving sales. Diversification of manufactured products is also seriously considered as a means toward equalizing the flow of production in an otherwise highly seasonal business.

Continuous Casting of Metals

During the World Metal Congress at Chicago, last month, the following continuous-casting processes were listed which are in commercial use or in pilot-plant use:—

For Copper-base Alloys:
Asarco.
Junghaus-Rossi.
Inco (Benard).
Lobeck (D.C.).
Hazelett.

For Aluminium:
Dow Chemical.
Properzi.
Hunter-Douglas.
Tessman.
Hazelett.
Goss.
Hunter Engineering.
Regamonti.

For Magnesium:
Dow Chemical Company.
Hazelett.

For Zinc:
Harrison.

For Steel:
Babcock & Wilcox.
Hazelett.
Junghaus-Rossi.

In commercial operations, one or more of these processes are producing from two to 20 tons per hour in solid and hollow sections, tubes and shapes, in commercial sizes.

News from South Africa

Expansion Programme

The new blast furnace of the African Metals Corporation at Newcastle, Natal, is expected to start up in 1959. With this furnace in operation the production of foundry pig-iron will be increased by 180,000 tons per annum. The 7,500 kva electric furnace at the Kookfontein Works of African Metals Corporation was scheduled for commission in September. This new furnace brings up the capacity of the Kookfontein Works to 50,000 kva, comprising six tank furnaces and two refining units. In addition there is in operation an electric furnace and auxiliary equipment for the production of di-calcium phosphate.

Blast-furnace Plant

In connection with the existing blast-furnace plant at Newcastle, Natal, African Metals Corporation Limited, has placed orders with the following firms: Ashmore, Benson, Pease & Company Africa (Pty.), Limited, blast furnace; Gutehofnungshütte through C. F. and H. Rolfes Bros. (Pty.), Limited, turbo-blower; Combustion Engineering, Africa (Pty.), Limited, steam-raising plant. These orders together total more than £1,000,000, and deliveries will start in the near future. Further orders will shortly be placed for auxiliary items of plants.

A-Project Experts

Dr. H. S. Arms, chief engineer of the English Electric Company's atomic-power division at Whetstone, England, has visited the Union to interview and select young South African engineers who will be employed for work on the design and development of atomic stations in Britain, such as the world's largest which is to be built at Hinkley Point, Somerset. He was accompanied by Mr. W. G. Thomas, assistant to the general manager of the company's atomic-power division. Dr. Arms and Mr. Thomas saw about 20 mechanical engineers aged between 23 and 35 who were among the applicants to the English Electric Company for jobs on atomic-energy projects in the United Kingdom. Most of them came from the Transvaal and the Cape.

Opening Ceremony

The new sales and service depot of Guy Motors Africa (Pty.), Limited, head office, Benrose Township, Johannesburg, was opened officially by Dr. H. J. van Eck, chairman of the Industrial Development Corporation, in September. He spoke of the importance of transportation in every aspect of daily life, more particularly in a country with great distances to cover, and in this connection he dealt with problems presented by road wear. "Imports of motor vehicles and accessories into the Union last year amounted to £48,300,000," said Dr. van Eck, "and approximately 50 per cent of this figure came in the form of vehicle parts ready for assembly. The total capital invested in motor vehicles in South Africa is therefore stupendous and may now not be far from the £1,000,000,000 figure. The need for maintaining and servicing this great capital value need not be emphasized because we must make the old vehicles last as long as we can. We cannot just continue buying new vehicles from abroad. The extreme importance of servicing and contact with the customer has been recognized in the establishment of this depot."

Extension Scheme

Extensions to the steel foundries of Scaw Metals, Limited, Union Junction, Germiston, were commented upon by the general managing director, Mr. W. F. Boustred, in his annual report in November. In 1955, Mr. Boustred and his son, Mr. W. G. Boustred, technical director and general manager, went overseas to discuss technical and design agreements with leading corporations in America and the United Kingdom. As a result of this tour, agreements were reached between Scaw Metals, Limited and the General Steel Castings Corporation, Granite City, St. Louis, Miss., USA, a firm which is recognized as leading in the field of castings for railway requirements under the trade name of Commonwealth Products. In England a similar manufacturing and design agreement was reached with English Steel Castings Corporation, Limited, of Sheffield.

The issued capital of Scaw Metals, Limited, is 3½ million ordinary shares at 4s. each and 300,000 accumulated preference £1 shares at 5½ per cent. The constitution of the board is such that the following mining groups are represented: General Mining and Finance Corporation, J.C.I., New Consolidated Gold Fields of S.A., Limited, and Anglo-American Corporation. The proposed extensions are estimated at £640,000 and will involve the installation of modern plant and the introduction of modern methods of production of high-quality steel castings for the Railways, the mining industry and secondary industry in general.

Two of the engineers of the firm, Mr. E. H. Dreyer, development engineer, and Mr. R. S. Boustred, foundry manager, have been overseas this year to study the techniques employed in the overseas corporations with which Scaw Metals, Limited, has agreements.

Installation of New Plant

South Africa's first electronically-controlled die-casting machine was installed recently in the Robertsham works of Josiah Parkes & Sons (South Africa), Limited, Johannesburg. This local application of the latest trend in electronics towards automation is being used to speed the production of die-cast zinc-alloy lock components having constant density, quality and finish. Rapidly increasing production led to the decision to instal one initial machine with sufficient ancillary equipment for future expansion. The decision was taken in July of last year, and eleven months later the first castings were produced. Two new factory bays were built, providing 3,600 sq. ft. of space for the possible accommodation of three machines with ancillary equipment.

The particular interest of this installation derives from its completely electronic control, for whilst machines similar to the one installed have been in local production for some time, they have not been electrically timed. Technical advice was furnished by the Wolverhampton Diecasting Company, Limited, England, who supply the parent firm with all its die-castings. The machine installed is a Schultz G.J. 21-in. hydraulic, electronically-controlled, hot-chamber pressure-die-casting machine, designed and patented by Schultz Diecasting Company, Toledo, Ohio, USA. It was manufactured in Glasgow under licence by the Henderson Engineering Company, Limited, for Vincent Engineering Company, Limited, United Kingdom agents for the Schultz company. The electronically-controlled safety circuit, designed by the company's technical staff, will close down the plant automatically in the case of the following conditions: Flame failure; gas-pressure fall or failure; air-pressure failure; and power failure.

BENNIS COMBUSTION, LIMITED—Mr. J. S. A. Hodge, Mr. N. C. Crighton, and Mr. E. L. Hollinshead have been elected directors.

Book Review

Design in Structural Steel, by John E. Lothers. Published by Longmans, Green and Company, Limited, 55, Fifth Avenue, New York, 3 (and 6, Clifford Street, London, W.1); price 56s. net.

This book is a well-written treatise on the design of structural steelwork, by an American Professor of Architectural Engineering. The contents have obviously been chosen to suit the special needs of the American civil and structural engineering student, as the design methods described are all in accordance with the latest American specifications, in particular, "Specifications for Buildings (1949)," published by the American Institute of Steel Construction, and "Specifications for Steel Railway Bridges (1950)," published by the American Railway Engineering Association. These specifications, although similar in approach to the corresponding British specifications, differ in detail on almost all design aspects.

The author has, in general, restricted this volume to the analysis and design of statically determinate structures. No proofs are given of the well-known elastic theory relationships used in the text, since the reader is assumed to have a knowledge of "Strength of Materials and Theory of Structures" comparable to the first year of a university engineering degree course. After a brief introduction in chapter 1 on American handbooks and computations, the author proceeds in chapter 2 to discuss the design of simple rolled-steel sections against failure due to bending, shear, web buckling and crushing. Chapter 3 describes the design of rolled-steel tension and compression members, and a very thorough account is presented in chapter 4 and 5 of the design and detailing of connections, using rivets, ordinary bolts, high-tension bolts, pins and welding. Chapter 6 is concerned with the design of beam and column baseplates; chapter 7 with the design of compound beams and of both riveted and welded-plate girders. In chapter 8, the author describes the analysis and design of simple roof-trusses and of columns subjected to gantry-crane loading, and this is possibly the sole reference of particular as distinct from general interest to founders, the final chapter explains the current American road and railway standard loadings and their use in the design of simply supported truss bridges.

The principles underlying the design procedures are explained in a clear and concise manner, and a full understanding of the problems involved is aided by reference, wherever possible, to the results of American research work, though references to European research work are noticeably absent. There are numerous worked examples and many for solution by the student, in most cases with answers, but for these computations an American handbook of rolled-steel sections will be necessary. The diagrams provided are all well drawn, but the photographs of steel bridges and buildings would appear to be included for their architectural rather than their technological interest, since they reveal little detail and are scarcely referred to in the text.

This book, then, is primarily a textbook on structural steelwork design for the American civil and structural engineering student. At its comparatively high price its appeal to the British engineering student will be limited, but to those who wish to broaden their knowledge of design by a study of current American practice this book can be strongly recommended.

K. O. KEMP.

Publications Received

BISRA Survey, 1957. Published by the British Iron and Steel Research Association, 11, Park Lane, London, W.1.

Amongst the many aspects of the improvement carried out for the benefit of the iron and steel industry which are detailed in this very interesting survey, is one covering sulphur removal. The subject is dealt with by the following statement:—

There has recently been considerable progress in the important problem of removing sulphur from iron and steel. Work has been carried out on three methods. First, attempts have been made to reduce the sulphur entering the blast furnace by increasing the amount removed during sintering. Controlled ignition, pre-heated air, and double-layer sintering all help to increase the desulphurization without reducing the yield of strong sinter. Experimentally, it has been found possible to remove over 90 per cent. of the sulphur compared with the 70 to 80 per cent. achieved in normal practice. This means that the sulphur content of the sinter can be cut to less than half.

Iron-making practice at the Steel Company of Wales has shown that low-sulphur low-silicon pig-iron can be produced by using suitable highly basic slags. Slag composition is calculated from a series of diagrams, recently published in America, which show slag compositions for different alumina contents over the range of 0 to 35 per cent. (in 5 per cent. steps). Optimum compositions are chosen to combine maximum desulphurization and a liquidus temperature not exceeding 1,500 deg. C. The validity of these diagrams has had further support from direct measurements of the liquidus temperatures of over 150 slags, carried out at the blast-furnace laboratory at Imperial College, South Kensington; all these temperatures were found to be close to those predicted by the diagrams.

Sulphur-reduction in liquid iron can of course be achieved by the familiar soda-ash method. However, a new process employing lime has been developed by the French research organization IRSID. Here a form of converter containing the hot metal is bottom-blown with a blast of air or nitrogen carrying powdered lime in suspension, reducing the sulphur content from, for example, 0.1 to 0.003 per cent. within five minutes. The process is to be used commercially on a 1,000 tons-per-day plant in France.

Increased sulphur removal can, therefore, be achieved at each or all of three stages—during sintering, during smelting in the blast furnace, and immediately before steelmaking. Choice of method will, of course, depend on individual circumstances, but between them these developments represent a substantial advance in solving what has for long been a formidable problem.

The Pound and Our Future. Prepared by the Treasury and published by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2; price 6d. with reduction at £19 5s. for 1,000 copies, postage paid.

This book is not a treatise on economics, but an illustrated pamphlet designed to tell the man in the street just what inflation means to him. This not-too-easy task has been exceptionally well carried out by text and the now-familiar cartoons. Two major aspects have been stressed—the value of the pound at home and its value abroad, which after but a short lapse of time become the same thing. The price of the booklet has been kept low in order that wide distribution *via* works organizations can be arranged—a course that readers of this JOURNAL may care to adopt.

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News in Brief

RADIATION, LIMITED, London, W.1, have introduced two new models to their range of gas cookers. They have been designated the New World Rangette and the New World Forty-Two gas cooker.

THE NON-FERROUS CLUB, at its meeting on December 4, was addressed by Mr. E. A. Eden, secretary of the Birmingham Football Association. A collection on behalf of the *Birmingham Post and Mail* christmas-tree fund realized £11 14s. 6d.

EDGAR ALLEN & COMPANY, LIMITED, Sheffield, will shortly despatch to Iran a large tube mill, which is in the final stages of construction at the Sheffield works. The mill weighs about 130 tons, and after completion will be dismantled to facilitate transport.

ALLIED IRONFOUNDERS, LIMITED, announce a new model of domestic convector fire—the Rayburn No. 2. A special feature is an adjustable head which permits it to fit neatly in any existing fireplace from 22 to 24½-in. high (or without the head 19 in.). It is available attractively vitreous enamelled in seven shades.

AFTER an inspection of Sordwana Bay on the Northern Zululand coast, the S.A. Minister of Transport, Mr. Schoeman, is reported to have expressed the opinion that a harbour at Sordwana Bay would provide an invaluable outlet for the coal of Natal and the Eastern Transvaal, and for the manganese and iron ore in the area.

THE LARGEST ORDER yet placed for British buses with fully-automatic gearboxes has just been received by Leyland Motors, Limited, from the Department of Government Transport, New South Wales. Valued at over £350,000, the contract has been placed within 12 months of putting in service a fleet of 125 underfloor-engined buses with semi-automatic gearboxes.

A REVISED EDITION of the pamphlet on science in the "Careers for Men and Women" series (No. 37, H.M. Stationery Office, price 9d.) is now available. The pamphlet has been revised pending the publication of new booklets on scientific careers in the "Choice of Careers" series (intended for boys and girls considering the future direction of their studies at the age of about 15 or 16).

SPEAKING AT THE ANNUAL DINNER of the firm's Staff Association, Mr. S. C. Tyler, head of the export sales department of Peglers, Limited, brassfounders, Belmont Works, Balby, Doncaster, said that it was hoped to extend sales to iron curtain countries in addition to the many present overseas markets; he added that confirmation of a large order from Formosa was expected. The company now traded in 50 different markets overseas.

THE TENTH LIEGE INTERNATIONAL FAIR will be held from May 10 to 26, 1958, a fortnight later than usual in order to avoid a simultaneous opening with the Brussels Universal and International Exhibition. The closing date for space applications is January 31, 1958. Further information is available from the UK representative, Mr. R. C. Liebman, 178, Fleet Street, London, E.C.4, at which address space can also be booked and Fair vouchers obtained.

AGREEMENT HAS NOW BEEN REACHED on the settlement of the commercial debts owed to United Kingdom creditors by Colombia. An initial payment of 20 per cent. of the amount outstanding has been paid by the Colombian Banco de la Republica to the Bank of London and South America which is acting as its London agent for the purposes of the settlement. The Bank of London and South America will be getting in touch with the creditors with regard to the details of individual settlements as soon as possible.

BRITISH-MADE TRIUMPH motorcycles have been chosen for service with the Swedish army. First deliveries of 100 machines—part of a "substantial" initial order worth £50,000—are now being made, and it is understood that further orders may follow. The type chosen is the 500-cc. twin-cylinder TR5 model, with modifications to meet special conditions under which they will operate. For example, they will be equipped with brackets so that skis can be fitted to enable the machines to be used over snow.

A SUBSIDIARY COMPANY has been formed in the USA by Megator Pumps & Compressors, Limited, 43 Berkeley Square, London, W.1, to handle their American business in industrial and marine self-priming pumps. The new company, known as Megator Pumps & Compressors Inc., will be responsible for marketing pump sets—produced in the UK by the parent company to American standards—throughout the United States, and will provide efficient after-sales service when required. The address of the company is 930, Manchester Avenue, Pittsburgh 12, Pa., USA.

THE EARL OF VERULAM, chairman of Enfield Rolling Mills, Limited, addressing members of the Worcester Management Association at their December meeting, said that because of the growth of industry and business organizations of all kinds, people were sometimes inclined to get the impression that size was strength, but it should not be forgotten that the most priceless asset of a company was one that did not appear in the balance sheet, namely the individual. There was a greater awareness of this fact in the smaller industrial nations such as Sweden, Switzerland and Australia.

ACCORDING to a report in the *Yorkshire Post*, employees were leaving the Maltby Ordnance Factory so quickly that it was probable it would be closed long before the official date in June, 1958. The factory was indeed "just crumbling" and there was no chance at all of saving it. Most of the men were taking jobs with private enterprise concerns in South Yorkshire and only a few were accepting transfer to the Blackburn factory. It was reported also that a British Railways spokesman had denied any knowledge of a reported interest by British Railways in the acquisition of the factory.

FREDERICK TOWN & SONS, LIMITED, manufacturers of radial drilling machines, Mile Cross Works, Halifax, have completed reorganization and expansion of their works. The machine shops now have 24,000 sq. ft. of floor area. About 65 per cent. of the output is exported. The firm was founded in 1903 by the late Mr. Frederick Town and a son; the Mile Cross Works were completed early in the first world war and a foundry added ten years later. In 1954 the entire share capital of the company was bought by Thos. W. Ward, of Sheffield, and Mr. Eric Town, grandson of the founder, was appointed director and general manager.

Mr. GEORGE P. TINKER, managing director of Birlec, Limited, Birmingham, is on a visit to the Union of South Africa to investigate the market potentialities for the company's electric furnaces. At the same time Mr. Tinker is taking the opportunity to meet some of the country's foremost industrialists and to inspect most of the important electric-furnace installations. Birlec already have over 100 plants in South Africa, totalling some 60,000 kva. Mr. Tinker is also investigating the possibility of manufacturing Birlec furnaces in the Union and on a recent large contract it has already been arranged that over half the plant will be built locally.

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Personal

Sir ANDREW MCCANCE has been elected to the board of Harland & Wolff, Limited, in place of the late Sir JOHN CRAIG.

Mr. ALEXANDER ROBERTSON has been appointed to the board of Glenfield & Kennedy Holdings, Limited. He is managing director of the subsidiary, Alley & MacLellan, Limited.

Mr. LESLIE RUE, who was trainee manager for two years just after the war with Power Installations, Limited, Leicester, has been appointed commercial manager of the company. Power Installations was recently acquired by Goodenough Pumps, Limited, Byfleet (Surrey).

Mr. A. C. LESTER, managing director of the Coldbath Foundry, Limited, Islington, London, N.1, arrived with his wife in Johannesburg on November 19. During his visit he attended the November meeting of the South African branch of the Institute of British Foundrymen and conveyed the greetings of the London branch.

Mr. J. C. COLQUHOUN is resigning as managing director of the Manganese Bronze and Brass Company, Limited, at the end of the year. Mr. Colquhoun will, however, remain as chairman and continue to take an active interest as an executive of the company. Mr. E. ROBSON, deputy managing director, has been appointed managing director as from January 1.

The gift of a gold watch to mark the completion of 50 years' unbroken service with the firm of H. W. Lindop & Sons, Limited, malleable ironfounders, of Walsall, has been made to Mr. L. F. WALTON. From members of the staff he received a table lighter. Mr. Walton, who joined the firm in September, 1907, has worked in practically every department, and in recent years has been coreshop manager.

Cambridge Instrument Company, Limited, announce that Mr. W. H. APTHORPE, managing director, will retire from executive duties at the end of the year. He will retain his seat on the board, and will continue to be available for special duties as deputy chairman. Mr. Apthorpe will be succeeded by Mr. H. C. PRITCHARD at present holds a senior responsible position with Elliott Bros. (London), Limited. He will take up his duties as managing director on January 1.

At the Midland Hotel, Bradford, departmental managers and senior staff of the Crofts Engineers (Holdings), Limited, group were entertained by the directors at a dinner, at which the guest of honour was Mr. A. T. RUDD, who has served the company for 50 years; he is at present commercial manager of the parent company at Bradford. Mr. John Croft, the group's deputy chairman, acting on behalf of his father, Sir Arthur Croft, presented Mr. Rudd with a cheque and a television set.

Darwins, Limited, steel manufacturers, Fitzwillian Works, Tinsley, Sheffield, announce that Mr. L. BELLAMY, Mr. S. A. ROBINSON, Mr. L. SARGENT, Mr. A. G. STANLEY and Mr. D. WATERHOUSE have been appointed a local board as part of an extension programme. Mr. Bellamy will continue as works manager of the Beeley Wood Forge, Oughtibridge, and the Herries Forge, and Mr. Sargent has been appointed works manager of the foundry and engineering divisions at Fitzwilliam works.

Following the retirement of Mr. J. RAINS, as managing director of J. W. Rains, Limited, the board of Parker Winder and Achurch, Limited announces that it has appointed two of its directors, Mr. H. E. SLAUGHTER and Mr. R. L. TEARE to the board of J. W. Rains. Mr. Teare, who has been secretary of the company for the last eight years, has been released for whole-time secretarial duties at J. W. Rains. The assistant secretary, Mr. B. BILLINGTON, has been appointed secretary of the parent company.

WHEN MR. ANDREW THOMPSON retired recently, after 54 years' continuous service with Smith Patterson Company, Limited, Blaydon-upon-Tyne, he was presented with a silver salver from the company and a silver bowl from the chairman, Sir Jonah Walker-Smith and Mr. W. M. Dodds, joint managing director. Smith Patterson Company, Limited, was formed in 1873 and as it produces up to 500 tons of iron castings per week it ranks amongst the largest foundries on the North-East coast. Mr. Thompson is to be succeeded by Mr. JOHN PICKERING (see photograph on page 722).

Mr. LEWIS T. WRIGHT, general secretary of the Amalgamated Weavers' Association, has been elected chairman of the British Productivity Council for the coming year. He succeeds Lord MCCORQUODALE, a vice-president of the British Employers' Confederation, who has retired after the customary year of office. Sir MILES THOMAS, chairman of Monsanto, is the new deputy-chairman in place of Mr. Wright, who is a member of the General Council of the Trades Union Congress. Lord McCorquodale has agreed to continue as chairman of one of the Council's key committees.

Mr. T. W. HEATHER, Mr. A. L. G. LINDLEY and Mr. R. E. ROBINSON have been appointed assistant managing directors of the General Electric Company, Limited. Mr. D. G. W. ACWORTH and Mr. W. J. BIRD have been appointed directors. Mr. Heather will be responsible for the general products group, production and home sales; Mr. Lindley, engineering group, production and sales, home and export; and Mr. Robinson, telecommunications group, production and sales, home and export. Mr. Acworth will take charge of all overseas companies and export sales. Mr. Bird will be in charge of home sales of the general products group.

Obituary

The death has occurred at the age of 53 of Mrs. RACHEL SADD NEEDHAM, a director of the Stockport iron and non-ferrous founders, John Needham & Sons, Limited.

Mr. ARTHUR FRANCIS DAWE, formerly of the buying department of Marshall Sons & Company, Limited, engineers, Gainsborough, died on December 5, at the age of 72.

The death has taken place at the age of 74 of Mr. SAMUEL BELL MACMURRAY, who, for many years until his retirement, had been welfare officer at the Scunthorpe steelworks of Thos. Firth & John Brown, Limited.

Mr. WILLIAM E. FINCHAM, foundry superintendent at the works of J. Hobkirk, Sons & Company, Limited, Ampthill Road, Bedford, collapsed and died suddenly as he was leaving the works. He was 49 years old and had been with the firm for about 33 years. He joined the Institute of British Foundrymen in 1954.

Mr. W. PYATT, who, up to his retirement in 1950, was technical sales representative for General Refractories, Limited (for London and the Home Counties), died early this month. Previously, he was with J. Grayson Lowood & Company, in a similar capacity. A member of the London branch of the Institute of British Foundrymen since 1930, Mr. Pyatt was widely known and respected amongst founders.

Greater loads... higher lifts... longer flights with

GOODYEAR

RAYON CONVEYOR BELTS

A full range of rayon-carcass conveyor belts is available from Goodyear for applications where higher tension ratings are desirable. The special advantages of rayon belts make possible a fresh approach to new installations; and also help to eliminate many difficulties with existing installations.

Manufactured in three different weights of rayon and to a wide variety of cover specifications, we are able to supply the most economical belt for any type of service. With knowledge of your operating conditions we will gladly advise on the Goodyear rayon-carcass belt best suited to them.

Greater Efficiency

Higher tensions, with ample safety factor and less stretch, permit greater loads, longer flights and higher lifts. This means simpler layout, fewer transfer points and easier sequence control.

Better Troughing

The thinner construction ensures better troughing and less dead weight on highly-rated belts. The higher grades of rayon belting have ratings away above anything that is practical in cotton construction, and yet trough perfectly.

Longer Belt Life

Extra flexibility means that belts can wrap driving rollers and snub idlers more closely, yet retain the excellent impact resistance needed for loading points. Belts therefore last longer.

STACKER

Designed for use where a superior quality belting is demanded by the frequency and severity of abrasion and flexing. Ideal for coke, ores, stone and other highly abrasive materials. Available with either rayon or cotton carcass.

GOODYEAR

INDUSTRIAL RUBBER PRODUCTS

CONVEYOR BELTING · HOSE · V-BELTS · TRANSMISSION BELTING · FENDERS

Raw Material Markets

Iron and Steel

No appreciable changes in the present trading conditions at the ironfoundries are expected for the remainder of the year. The present pattern of business has followed closely on the same lines for some months, during which time a section of the engineering foundries has been able to obtain much improved outputs of castings required by the motor-vehicle industry. These foundries are now enjoying a better level of business and this is expected to continue for some time.

This improvement is reflected in the figures issued by the Iron and Steel Board for production of iron castings for the third quarter of the year. A total of 125,500 tons of castings was supplied to the automobile industry, as against 94,400 tons for the third quarter of 1956, showing an increase in production of 32.9 per cent. A reduction in outputs of castings of 6.2 per cent. for the third quarter of 1957, compared with the 1956 figure, is shown for castings supplied to engineering trades (including machine tools, textile machinery, electrical trades, etc.). The foundries connected with these trades maintain a good level of production, and it is expected that from some sections, notably the machine-tool trades, improved production figures will be obtained for the fourth quarter.

The engineering and speciality foundries are utilizing large quantities of pig-iron, chiefly in the low-phosphorus grades, hematite, and to a lesser extent the refined irons. Production at the furnaces of these pig-irons is maintained at good levels; the low-phosphorus pig-iron is generally readily absorbed, but there are plentiful supplies of most brands of hematite, and refined irons are easy.

In the light casting trades, although the production figures for the third quarter of 1957 show only a slight decrease of 1.2 per cent. below the 1956 figure for the building and domestic trades, business at these foundries is very slack and there is no sign of an improvement. Producers of high-phosphorus pig-iron continue to feel the effects of these depressed conditions which restrict sales and enforce a rise in stocks. Outputs of the high-phosphorus pig-iron fluctuate with the demand for basic pig-iron from the steelworks as, from time to time, some furnaces are switched over to the latter grade. Good stocks of the foundry iron are available to meet demands which fall far short of the tonnages available.

Scrap supplies at the foundries are adequate for current needs and demands are mainly for the heavier and better grades of cast-iron and machinery scrap. Coke deliveries are generally satisfactory, but in many grades it is difficult to obtain increased tonnages as the coke ovens are fully covered for their outputs. Ganister, limestone, and firebricks are received to requirements.

The position at the re-rollers shows little change. Those producing reinforcing rods, sheets, and the larger sizes of bars and sections are fairly well employed. Small bars and light sections continue to be called for in reduced quantities, and present demands do not provide sufficient work to keep the re-rolling mills fully occupied.

The re-rollers are well provided with steel semis, and could obtain larger quantities if required from home steelworks. The stocks which they had built up in both home and imported steel have been adequate to provide them with sufficient material for consumption needs for some time. On account of this fresh business continues scarce, particularly for the smaller sizes of billets.

Non-ferrous Metals

The copper price in London, after sinking to a new low since free dealings were resumed on the London market, firmed up at the close of last week, principally due to the threat of a strike at El Teniente in Chile. The possibility of a strike developing arises out of a proposed cut in wages for the miners in accordance with their present contracts in which wages are geared to the cost-of-living index. As it happened, the cost-of-living index fell 7 per cent. in October, thereby permitting a pay cut of 3½ per cent. However, Chilean labour leaders are not accepting the proposed reduction unless a compensatory bonus is paid.

If this strike does not develop the outlook for copper must be considered bleak. In the first place Chile has denied rumours that some of its copper producers have agreed to any cut back, stocks are still accumulating, and interest is at a low ebb—particularly in the US. In fact, the continued weakness of the price in London is placing additional pressure on the US producers to lower their quotation from 27 cents, which is 2 cents per lb. higher than the US custom smelter price. Moreover, the Belgians have further lowered their quotations and copper for export in America is now 23½ cents against 24 cents per lb. previously. If there is to be any change in the copper price on either side of the Atlantic before the New Year, all signs point to it being made in a downward direction.

The size of the export quota announced by the International Tin Council was much smaller than had been expected. The London market adjusted itself to the new situation in a few days at a price slightly higher than the floor price of £730 per ton. However, the need to support the market following a heavy inflow of metal, weakened the price, which is in the process of being restored as the Indonesian situation worsens. In the US the market is quiet, with the price fluctuating narrowly around 93 cents per lb.

Lead in London is very weakened, with the price falling below £70 per ton—the lowest for several years. Demand is poor and supplies are more than adequate to meet demand. The situation in the US is clearly reflected by the cut in the price of ¼ cent to 13 cents per lb. at which level the market is quiet.

Zinc is also quiet on both sides of the Atlantic. In America the fresh bout of lay-offs in the automobile industry and the closing down of furnaces in the steel industry are strong bearish factors, overhanging a shaky market. The US price is still called 10 cents per lb.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

WITNEY, OXON, January 1, 1958.—Water supply of Standlake, contract No. 1, for Rural District Council, consisting of cast-iron fittings for 12 miles of 3-, 4-, 6-, 7- and 10-in. dia. asbestos cement pipes. Documents from Howard Humphreys & Sons, Victoria Station House, Victoria Street, London, S.W.1, by December 20. Deposit £3 3s.

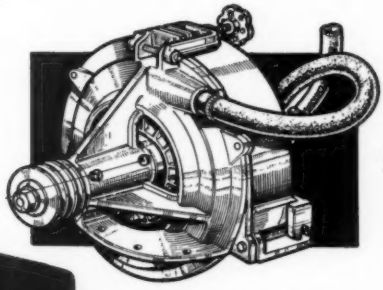
JAMAICA—R. Ehrensteen & Company, Limited, 40 East Street, Kingston, wish to represent in Jamaica a UK manufacturer of cast-iron rainwater and soil pipes. (ESB/28763/57.)

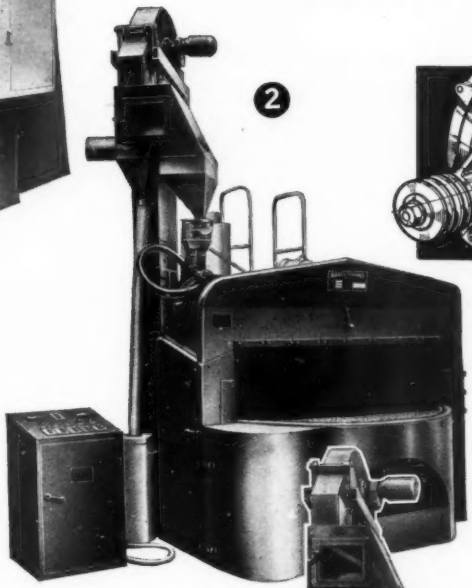
IRAN, December 24—Cast-iron pipes and fittings. (ESB/29796/57.)

INDIA, January 6, 1958—Diesel road rollers. (ESB/29138/57.)

Shot Blast Equipment

This A-S-L Turbine is the most modern Shot Blasting Unit available. The bi-phase air injection system enables shot to be projected at greater speeds using lower power with fewer replacements. The economies effected in spare parts alone are very substantial.





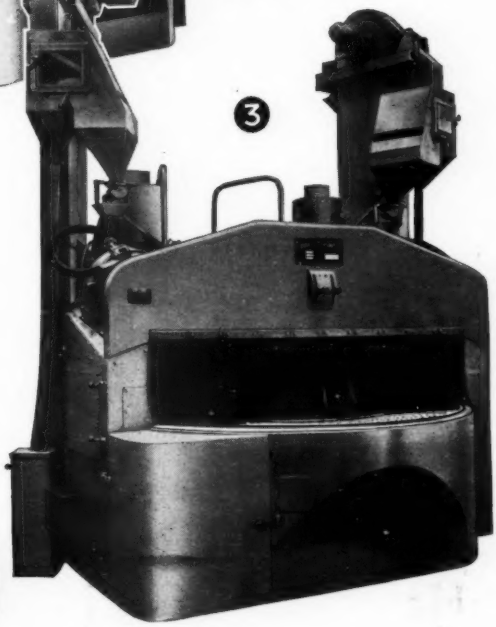
1 ROTARY BARREL

2 CADET

3 MEDIUM

Baker Perkins High Speed Bi-Phase A-S-L Turbine, British Patent, No. 510681.

These machines do not require pits or special foundations.



Our standard range of Rotating Barrel and Table Shot Blast Machines is capable of handling a wide range of Foundry products. Both types are semi-automatic, the rotating barrels being equipped with skip hoist loading gear and frontal discharge mechanism. These modern highly efficient machines are in use in Foundries all over the world, and are built to the high standards of design, materials and workmanship characteristic of all Baker Perkins' machines.

BAKER PERKINS LIMITED
ENGINEERS
WESTWOOD WORKS · PETERBOROUGH

Current Prices of Iron, Steel, and Non-ferrous Metals

(*Delivered unless otherwise stated*)

December 16, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S. 1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(*Per ton unless otherwise stated, delivered*)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £48 10s. 0d. to £50 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £68 10s. 0d. to £76 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 27s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 9s. 0d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 12s. 0d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £93 0s. 0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 32s. 0d. per unit; over 6 per cent. C, £91 0s. 0d., basis 60 per cent. Cr, scale 31s. 0d. to 32s. 0d. per unit; 2 per cent. C,* 2s. 2d. per lb. Cr.; 1 per cent. C,* 2s. 2½d. per lb. Cr; 0.15 per cent. C.* 2s. 3½d. per lb. Cr; 0.10 per cent. C,* 2s. 3¾d. per lb. Cr; 0.06 per cent. C,* 2s. 4d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 3d. to 7s. 10½d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 0d. to 22s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £87 19s. 3d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £33 1s. 6d.; tested, 0.08 to 0.33 per cent. C, £34 1s. 6d.; hard (0.41 to 0.60 per cent. C), £35 3s. 0d.; silico-manganese, £44 2s. 6d.; free-cutting, £37 5s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 7s. 0d.; silico-manganese, £44 10s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 16s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 18s. 6d.; acid, up to 0.25 per cent. C, £43 10s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 12s. 0d.; boiler plates (N.-E. Coast), £45 2s. 0d.; floor plates (N.-E. Coast), £44 1s. 0d.; angles, N.-E. Coast, £40 6s. 6d.; joists, N.-E. Coast, £40 2s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over, £40 8s. 0d. (under 10 tons to 4 tons, £41 5s. 6d.; under 4 tons to 2 tons, £41 10s. 6d.); hoop and strip, coils, £40 10s. 0d.; uncoated strip mill coils, hot-rolled, under 3mm. to 12g., £45 16s. 0d.; black sheets (hand mill), 24 g., £59 4s. 6d.; galvanized corrugated sheets, 24 g., £68 0s. 0d.

Alloy Steel Bars.—1 in dia. and up: Nickel, £69 9s. 6d., nickel-chrome, £100 12s. 6d.; nickel-chrome-molybdenum, £112 16s. 6d.

NON-FERROUS METALS

Copper.—Cash, £188 10s. 0d. to £189 0s. 0d.; three months, £193 0s. 0d. to £193 10s. 0d.; settlement, £189 0s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 9½d. per lb.; rods, 202s. 0d. per cwt. basis; 20 s.w.g., 235s. 3d. per cwt.

Tin.—Cash, £732 0s. 0d. to £732 10s. 0d.; three months, £740 0s. 0d. to £741 10s. 0d.; settlement, £732 10s. 0d.

Lead (Refined Pig).—Second half December, £72 5s. 0d. to £72 10s. 0d.; second half March, £72 15s. 0d. to £73 5s. 0d.

Zinc.—Second half December, £62 10s. 0d. to £63 0s. 0d.; second half March, £63 0s. 0d. to £63 5s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations £96 0s. 0d.; rolled zinc (boiler plates), all English destinations, £93 15s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £86 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 5¾d. per lb.; sheets to 10 w.g., 153s. 6d. per cwt. wire, 2s. 3½d.; rolled metal, 153s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65,35), £136; B6 (85/15), — ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £179, HTB2 (38 tons), — ; HTB3 (48 tons), — .

Gunmetal.—BS1400, LG2 (85/5/5/5), £166; LG3 (86/7/5/2), £178; G1 (88/10/2/½), £233; (88/10/2/1), —

Phosphor Bronze.—BS1400, PB1 (AID released), £248 per ton.

Phosphor Bronze Strip, etc.—Strip, 229s. 0d. per cwt.; sheets to 10 w.g., — per cwt.; wire, 3s. 6d. per lb.; rods, 2s. 9¾d.; tubes, 2s. 9¾d.; chill cast bars: solids 2s. 10¼d., cored 2s. 11¼d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide x 0.056, 3s. 5½d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 10d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 9d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £69 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £210; AB2, — .

* Average 68-70 per cent.